GAZETTEER OF HYDROLOGIC CHARACTERISTICS OF STREAMS IN MASSACHUSETTS--MERRIMACK RIVER BASIN

By S.William Wandle, Jr., and Richard A. Fontaine

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 84-4284

Prepared in cooperation with the

COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING

DIVISION OF WATER POLLUTION CONTROL

Boston, Massachusetts

1984

UNITED STATES DEPARTMENT OF THE INTERIOR

WILLIAM P. CLARK, Secretary

GEOLOGICAL SURVEY

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CONVERSION FACTORS

The following factors may be used to convert the inch-pound units published herein to the International System of Units (SI).

Multiply inch-pound units	By	To obtain SI Units
	Length	
inch (in)	25.4*	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
cubic foot per second per square mile [$(ft^3/s)/mi^2$]	0.01093	cubic meter per second per square kilometer [$(m^3/s)/km^2$]
	Slope	
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)

Temperature

Temperature in degrees Fahrenheit (^oF) can be converted to degrees Celsius (^oC) as follows:

$$^oC = 5/9\ (^oF-32).$$

*Exact.

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ABSTRACT

The Merrimack River basin in northeastern Massachusetts includes streams draining the Nashua (507 square miles), Concord (400 square miles), Shawsheen (78.0 square miles), and lower Merrimack (275 square miles) River basins. Drainage areas using the latest available 1:24,000 scale topographic maps were computed for the first time for ungaged streams draining more than 3 square miles and were re-computed for data collection sites.

Streamflow characteristics at 12 gaging stations were calculated using a new data base with daily flow records through 1981. These characteristics include annual and monthly flow statistics, duration of daily flow values, and the annual 7-day mean low flow at the 2-year and 10-year recurrence intervals. Seven-day low-flow statistics are presented for 79 partial-record sites and procedures used to determine the hydrologic characteristics of a basin are summarized. Basin characteristics representing 14 commonly used indices to estimate various streamflows are presented for 12 gaged streams. This gazetteer will aid in the planning and siting of water-resources related activities, and will provide a common data base for governmental agencies and the engineering and planning communities.

INTRODUCTION

Information on hydrologic characteristics, including drainage areas, frequency of low flows, and duration of daily flows, is necessary to plan and manage water-resources related activities. Governmental agencies and the engineering and planning community need streamflow and basin characteristics to satisfy requirements relative to waste assimilation, fisheries management, hydropower, land-use planning, stream-systems analysis, and water-resource development and management. No current hydrologic data base containing a comprehensive list of drainage areas, monthly flows, low-flow frequencies, and duration of daily flows is available for most of the Massachusetts stream systems. Drainage areas are available for selected sites where streamflow data are collected. Streamflow characteristics are presented in various reports, but these data, to be current, need to be re-analyzed using the latest available daily flow records.

In response to this need, a study was begun in 1980, in cooperation with the Massachusetts Division of Water Pollution Control, to analyze available streamflow and river-basin characteristics, and to compute subbasin drainage areas. This report is one in a series of gazetteers on

the hydrologic characteristics of the major river basins in the State. Gazetteers are also available for the coastal river basins of the North Shore and Massachusetts Bay (Wandle, 1984a), Connecticut River basin (Wandle, 1984b), Hudson River basin (Wandle, 1984c), Taunton and Ten Mile River basins (Wandle and Keezer, 1984), Housatonic River basin (Wandle and Lippert, 1984), Blackstone River basin (Wandle and Phipps, 1984), Thames River basin (Wandle and LeBlanc, 1984), and coastal river basins of the South Shore and Buzzards Bay (Wandle and Morgan, 1984). This report provides the first detailed listing of drainage areas and streamflow characteristics derived from daily flow records in the Merrimack River basin. The streamflow characteristics presented are an expansion and an update of those given in Brackley and Hansen (1977, 1982) and Gay and Delaney (1980a, 1980b).

Merrimack River basin in Massachusetts (fig. 1) includes the Nashua, Concord, and Shawsheen River basins and smaller basins draining into the Merrimack River in northeastern Massachusetts. The study area includes all or part of the following communities: Acton, Amesbury, Andover, Ashburnham, Ashby, Ashland, Ayer, Bedford, Berlin, Billerica, Bolton, Boxborough, Boxford, Boylston, Burlington, Carlisle, Chelmsford, Clinton, Concord, Dracut, Dunstable, Fitchburg, Framingham, Gardner, Georgetown, Grafton, Groton, Groveland, Harvard, Haverhill, Holden, Holliston, Hopkinton, Hubbardston, Hudson, Lancaster, Lawrence, Leominster, Lexington, Lincoln, Littleton, Lowell, Lunenburg, Marlborough, Maynard, Merrimac, Methuen, Natick, Newbury, Newburyport, North Andover, North Reading, Northborough, Paxton, Pepperell, Princeton, Rutland, Salisbury, Sherborn, Shirley, Shrewsbury, Southborough, Sterling, Stow, Sudbury, Tewksbury, Townsend, Tyngsborough, Upton, Wayland, West Boylston, West Newbury, Westborough, Westford, Westminster, Weston, Wilmington, Woburn, and Worcester.

Streamflow characteristics presented for the 12 continuously gaged streams are based upon a new sample of daily flow records in comparison to flow records used in Brackley and Hansen (1977, 1982), Hansen and others (1973), Gay and Delaney (1980a, 1980b), Higgins (1967), Knox and Soule (1949), and Male and Ogawa (1982). Streamflow records through the 1981 water year were available for this analysis. For each site, records were selected to represent a flow regime influenced by fairly constant river basin conditions (Wandle, 1983).

Drainage areas were computed for the first time for ungaged streams draining greater than 3 mi^2 and were re-computed for data-collection sites. Drainage divides, as delineated on the latest available 1:24,000 scale topographic quadrangle maps (Brackley and Wandle, 1982, 1983; Krejmas, 1982; Wandle and Frimpter, 1982) were used to calculate drainage areas. Drainage areas for most of the long-term gaging stations in earlier reports were computed using the drainage divides as outlined on 1:31,680 or 1:62,500 scale topographic quadrangle maps.

Streamflow data used in this study are a part of the historic streamflow data collected under agreements with State and Federal agencies and the U.S. Geological Survey. Most of the low-flow discharge measurements used in determining low-flow estimates at partial-record sites were collected during the water-resources investigations of the Nashua River basin (Brackley and Hansen, 1977), tributary basins to the Merrimack River from Salmon Brook to the Concord River (Brackley and Hansen, 1982), Shawsheen River basin (Gay and Delaney, 1980a) and lower Merrimack River basin (Gay and Delaney 1980b). The file of basin characteristics was created during an evaluation of available streamflow data in central New England (Johnson, 1970). This file is an expansion of the characteristics abstracted by Langbein and others (1947), and by Benson (1962). Basin characteristics were updated and additional characteristics were entered as part of a study to define floodflow characteristics of small streams (Johnson and Tasker, 1974; Wandle, 1982). The hierarchical stream list was compiled by the Massachusetts Division of Water Pollution Control and Massachusetts Division of Fisheries and Wildlife (Halliwell and others, 1982).

Data tabulated include drainage areas, basin and streamflow characteristics for gaging stations, including annual and monthly flow statistics, duration of daily flow values, and the annual 7-day mean low flow at the 2-year and 10-year recurrence intervals. Seven-day low-flow statistics for partial-record sites are also presented. An explanation of each procedure to determine the streamflow and basin characteristics is provided.

The authors thank the many persons who have kindly given time, information, and guidance during this study. Particular thanks are given to persons in the Geological Survey who assisted in the data collection and in the preparation of this report.

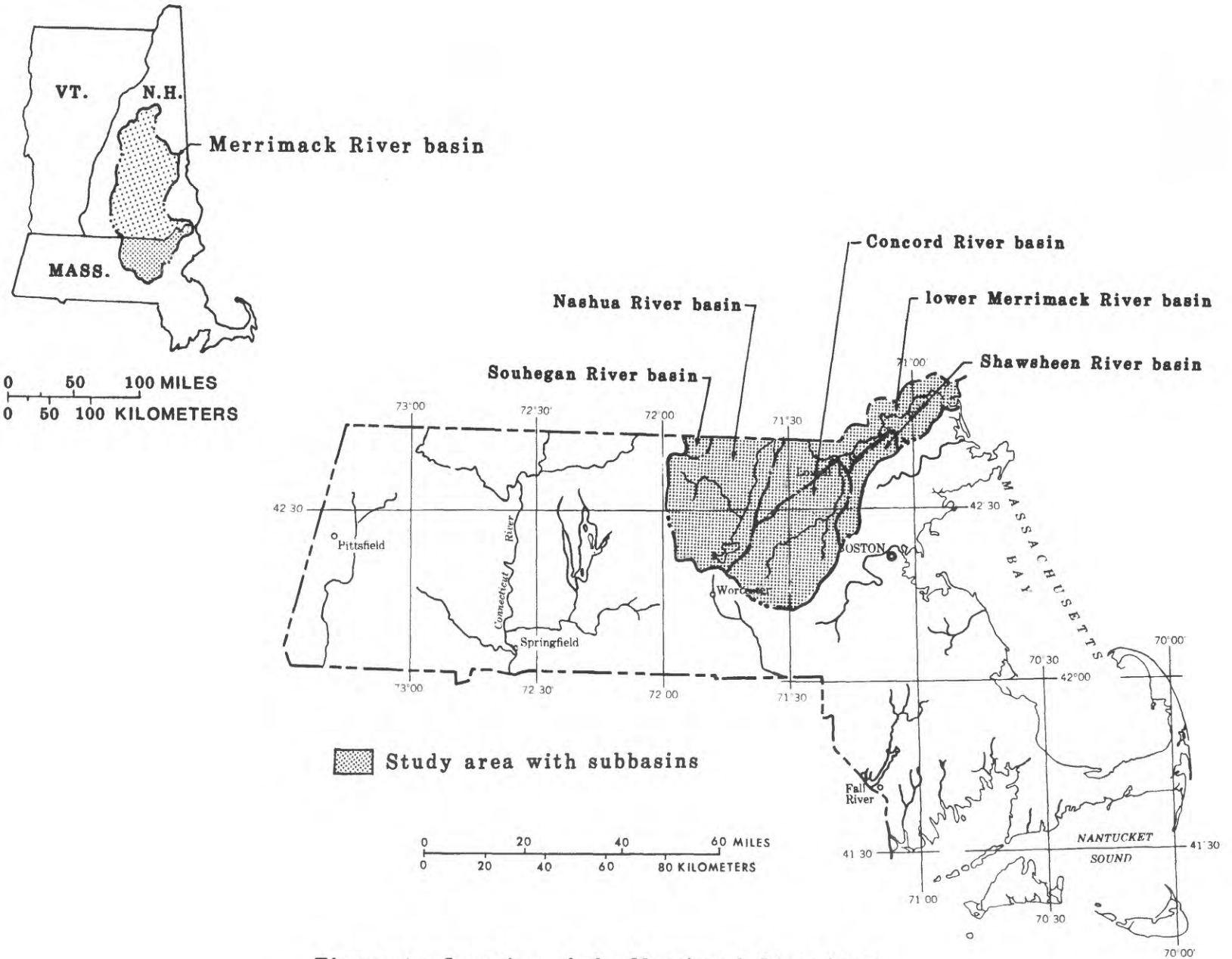


Figure 1.--Location of the Merrimack River basin

HYDROLOGIC DATA

Hydrologic characteristics are represented by various physical, climatic, and streamflow indices of a river basin. These characteristics can be determined either from available maps by following standardized procedures or from historic streamflow records.

Basin characteristics are indices of the physiography of the basin or of the climate prevailing over the basin and are measured on topographic quadrangle or climatic maps. Streamflow characteristics are computed from continuous records of daily flow or from a set of measurements during the occurrence of a specific event. Streamflow and basin characteristics are used in modeling stream quality, assessing water-resources conditions, analyzing impact of man's activities, and defining relationships to estimate flows or stream-quality parameters at ungaged sites.

Basin Characteristics

Drainage area is one of the most important variables in any hydrologic investigation or in the design of riverine structures. Drainage area is the most significant variable in the northeast that influences all streamflow except perhaps low flow in some regions. The physical boundary for many water-related studies corresponds to the limits for the drainage area upstream from the site.

For this study, drainage areas listed in table 1 (at the end of the report) were determined for the following sites:

1. Survey data-collection sites shown in figures 2-5. These sites include continuous-record gaging stations given in table 2 (at the end of the report), low-flow partial-record stations, miscellaneous sites, and water-quality stations.

2. Locations where the drainage area is greater than 3 mi^2.

3. Successive sites along a stream where the area between sites is at least 6 mi^2 on tributary streams and 10 mi^2 on the main-stem river.

The drainage basin divides for these sites were delineated on the latest available 1:24,000 scale topographic quadrangle maps. Subbasin drainage divides are shown in the series of statewide reports, "Drainage Divides, Massachusetts." The Merrimack River basin is covered by four reports in this series—Blackstone and Thames River basins (Krejmas, 1982), Taunton River basin and southeast coastal river basins (Wandle and Frimpter, 1982), Nashua and Concord River basins (Brackley and Wandle, 1982), and Ipswich and lower Merrimack River basins and northeast coastal river basins (Brackley and Wandle, 1983).

The subbasin drainage areas given in table 1 are indexed to the Massachusetts stream inventory prepared by the Massachusetts Division of Water Pollution Control and the Massachusetts Division of Fisheries and Wildlife (Halliwell and others, 1982) with some modification. Drainage areas were computed for sites meeting one of the three criteria mentioned above. The entire stream listing is included as a reference for stream order. This hierarchical listing begins at the mouth of a major stream and proceeds upstream with tributary streams indented under the main-stem stream. This order is followed to list all the named streams. Unnamed tributaries are included to maintain the hierarchy. The reader is referred to the inventory of rivers and streams report by Halliwell and others (1982) for a more detailed explanation.

The basin characteristics listed below are included because they represent indices that would remain reasonably stable over a planning period. They can be used in predictive models to assess impacts of proposed developments. The usefulness of these characteristics to explain the variability of various streamflow events has been demonstrated in hydrologic analyses (Thomas and Benson, 1970) and they can be readily measured from available maps. The 14 basin indices given in table 3 (at the end of the report) were computed according to the procedures described below. The indices for elevation, storage, lake area, and forest can be computed by the grid method which is explained after all the procedures are described.

Figure 2.--Location of the gaging stations and low-flow partial-record stations and miscellaneous sites in the Nashua River basin

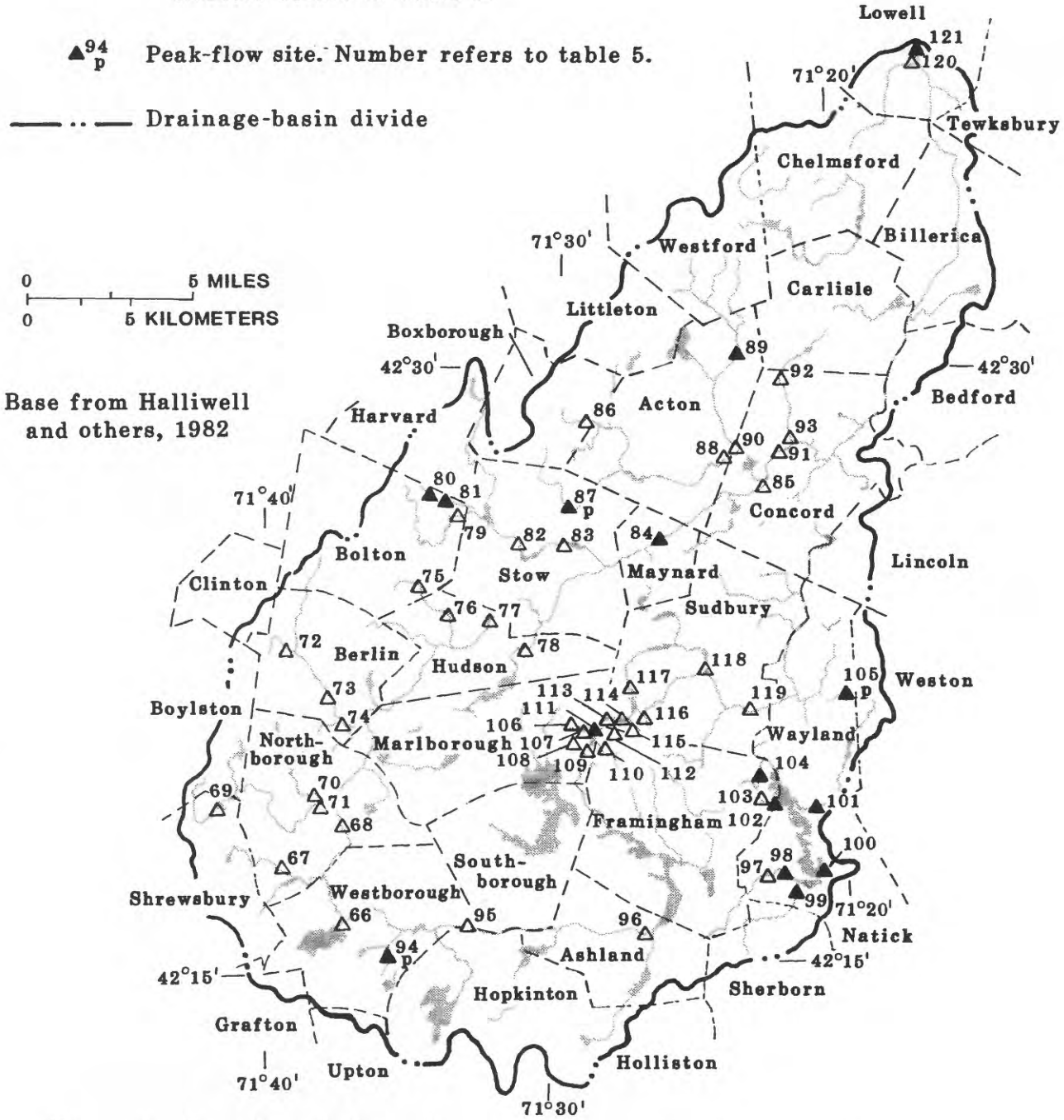


Figure 3.--Location of the gaging stations and low-flow partial-record stations and miscellaneous sites in the Concord River basin

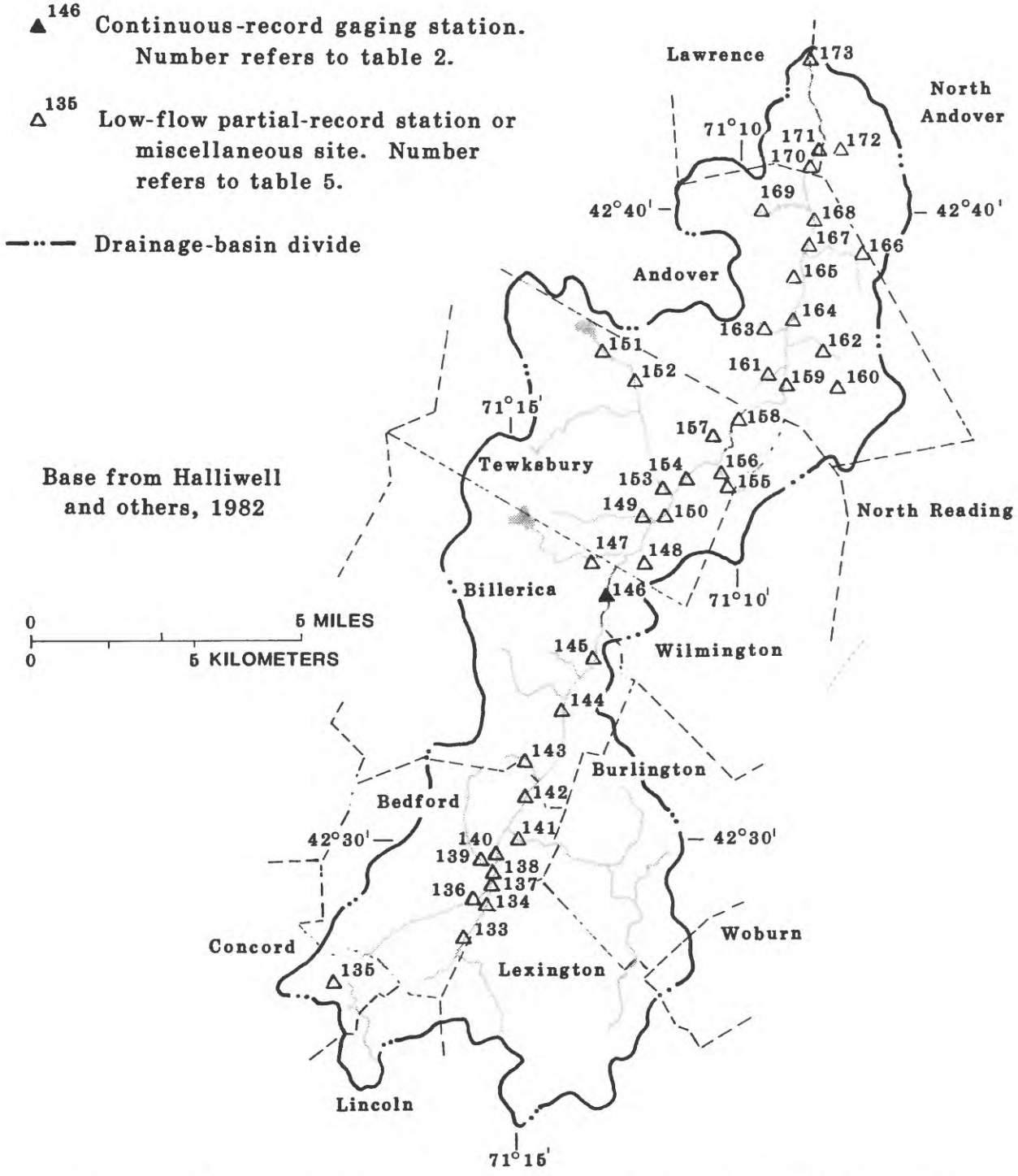
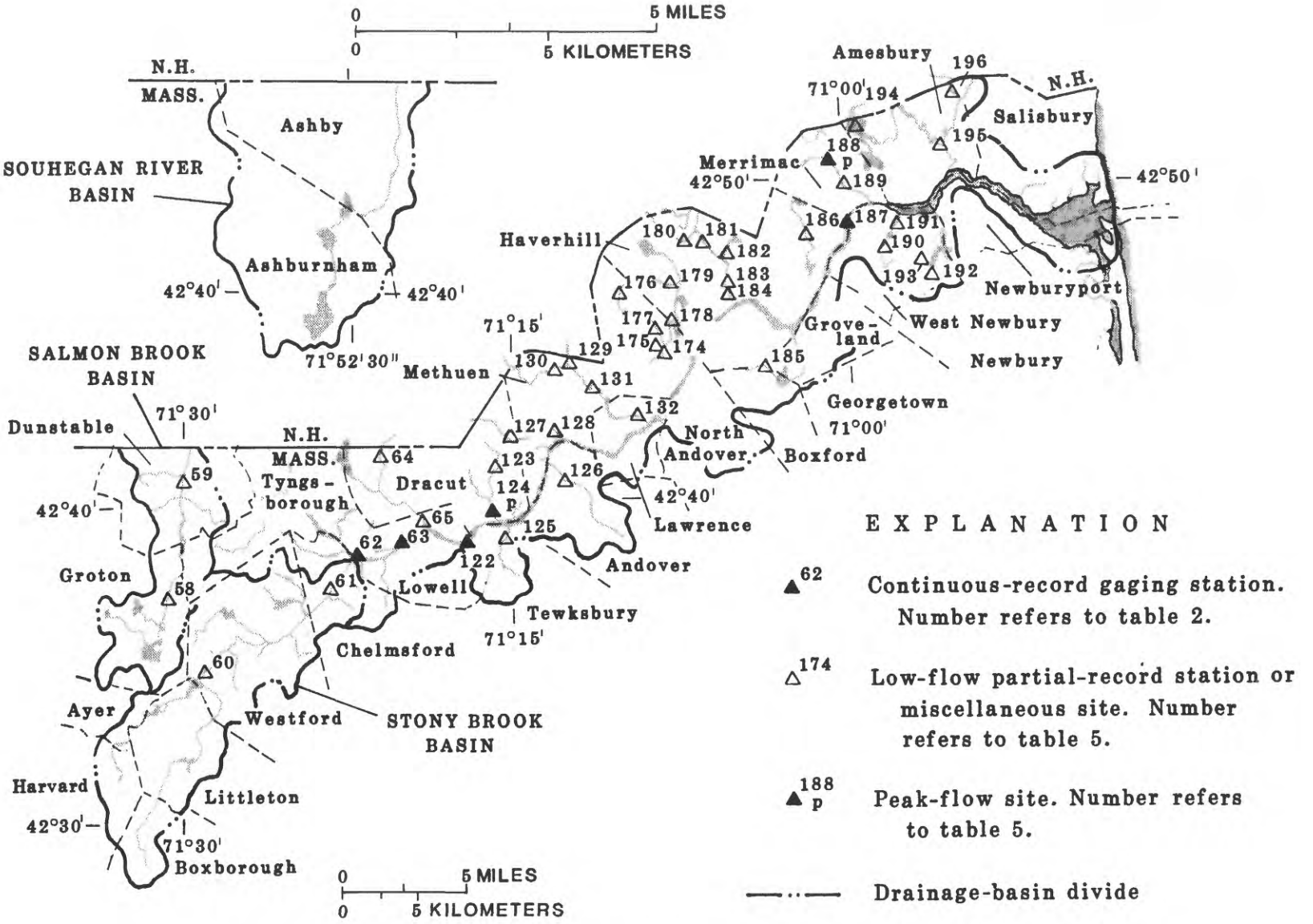


Figure 4.--Location of the gaging-stations and low-flow partial-record stations and miscellaneous sites in the Shawsheen River basin



Base from Halliwell and others,1982

Figure 5.--Location of the gaging stations and low-flow partial record stations and miscellaneous sites in the lower Merrimack River basin

1. Drainage area—Area, in square miles, as measured on the most recent 1:24,000 scale topographic quadrangle maps. Drainage area, as defined in the "National Handbook of Recommended Methods for Water-Data Acquisition" (U.S. Geological Survey, 1977), is "...the area of a river basin, measured in a horizontal plane, that is enclosed by a topographic divide such that direct surface runoff from precipitation normally would drain by gravity into the river basin.". Drainage area boundary lines are traced on topographic maps along divides indicated by contour elevations, starting at the point on the stream for which the drainage area is desired. These lines are drawn to cross a contour at right angles. Interpolation between contours may be indicated by reference to trails, old roads, or firebreaks in forested areas, all of which frequently follow drainage divides. Detailed information may also be obtained from highway or street profiles, from examination of aerial photographs, and from ground reconnaissance. Subareas within each quadrangle map were computed with an electronic digitizer using the procedures of the U.S. Federal Inter-Agency River Basin Committee (1951) as a guide. The coefficients to compute square miles from digitizer units were calculated using the known area of each 7.5-minute quadrangle or of the appropriate 2.5-minute quadrilaterals. Drainage areas for the subbasins were computed by summing the contributing areas.
2. Slope—Main-channel slope, in feet per mile, determined from elevations at points 10 percent and 85 percent of the distance along the main channel from the gaging station to the basin divide.
3. Length—Main-channel length, in miles, from the gaging station to the basin divide, as measured with dividers set to 0.1 mile or with a map measurer.
4. Elevation—Mean basin elevation, in feet above sea level, measured on topographic maps by laying a grid over the map.
5. Storage—Area of lakes, ponds, and marshes, in percent of total drainage area, measured by planimetering or by using a transparent grid. The marsh area includes the area of wooded marshes and marshes as defined by the appropriate topographic quadrangle map symbol. Storage area is the total area of all the lakes, ponds, and marshes expressed as a percentage of the total drainage area.
6. Lake area—Area of lakes and ponds, in percent of the drainage area, determined by the grid method.
7. Forest—Area of forest, in percentage of the drainage area, determined from the forest cover as shown on the topographic map with the green woodland overprint using the grid method.
8. Soil—Soil index, in inches, represents the value of potential maximum infiltration, during an annual flood, under average soil-moisture conditions. This characteristic, provided by the U.S. Soil Conservation Service (Dr. Benjamin Isgur, written commun., 1970), is a function of the soil and cover conditions in the basin. The index was computed from the runoff curve number following procedures in U.S. Department of Agriculture (1972).
9. Latitude—Latitude of stream-gaging station, in decimal degrees, determined by manual measurement.
10. Longitude—Longitude of stream-gaging station, in decimal degrees, determined by manual measurement.
11. Precipitation—Mean-annual precipitation, in inches, determined from the isohyetal map in Knox and Nordenson (1955). The variation in mean-annual precipitation is shown in more detail in this map than in more recent sources.
12. Precipitation intensity—Maximum 24-hour rainfall, in inches, having a recurrence interval of 2 years. This characteristic was determined from U.S. Weather Bureau (1959b).
13. Snowfall—Average total seasonal snowfall, in inches, from an isohyetal map in Lautzenheiser (1969).
14. January temperature—Minimum January temperature, in degrees Fahrenheit, determined from U.S. Weather Bureau, (1959a).

Several basin characteristics were measured following the grid method by using transparent grids to compute area or an average contour value. Storage area is determined by randomly placing the grid over the water and marsh area and counting squares. If the water and marsh area is large enough (about 30 squares), the number of grid intersections within the storage area are counted. The storage area then is computed as the product of the square size and the number of grid intersections. For measuring a contour value such as elevation, the grid spacing is selected to give at least 25 intersections within the basin boundary. The elevation at each grid intersection is determined and an average is computed. The percentage of a variable that is extensive in a drainage basin, such as forest cover, can be easily measured by counting the number of grid intersections occurring over the forested area, multiplying by 100, and dividing by the number of grid intersections within the basin.

Streamflow Characteristics

Historic daily flow records available in the Merrimack River basin were used to compute daily, monthly, and annual flow characteristics. A summary of these records is given in table 2 and the location of streamflow sites is shown in figures 2-5. These flow data were collected as part of the Survey's nationwide data-collection network through agreements with State and Federal agencies. Records of daily flow are available from the Survey's National Water Data Storage and Retrieval System (WATSTORE). This water-data computer processing system consists of several files containing data grouped by common characteristic and data-collection frequency.

The WATSTORE system includes site identification, daily values files, and computer programs that produce streamflow statistics. Hydrologic-data files are maintained for (1) parameters measured on a daily or continuous basis, such as streamflow values, river stages, water temperatures, specific conductance values, and ground-water levels; (2) annual peak values for streamflow and stage; (3) chemical analyses for surface- and ground-water sites; and (4) ground-water site inventory, including location, identification and geohydrologic characteristics. The data-processing, storage, retrieval, and analysis capabilities of WATSTORE are described in the system user's guide compiled by Hutchison (1975). Information on the availability of data analyses may be obtained from: U.S. Geological Survey, 150 Causeway Street, Suite 1309, Boston, MA 02114.

A brief description of the streamflow statistics computed using the WATSTORE system is included below. Streamflow characteristics representing annual, monthly, and daily flow statistics were selected for this analysis because they are useful in planning and design studies in this region. The streamflow statistics computed following the procedures given below are listed in table 4 (at the end of the report).

Annual and monthly flow characteristics (means and standard deviations) were computed for 12 gaging stations with the "Daily Values Monthly and Annual Statistics" computer program W4422 (Price and Meeks, 1977) using observed daily flow records. The maximum and minimum, monthly means (fig. 6 and table 4) were obtained from output provided by this program. The monthly hydrograph for North Nashua River near Leominster is shown in figure 6.

Characteristics of the flow-duration curve (the daily flow exceeded 99, 95, 90, 75, 70, 50, 25, and 10 percent of the time) were computed for 12 gaging stations by means of computer program A969, "Daily Values Statistics" (Meeks, 1977). An example of a flow-duration curve is given in figure 7. Low-flow characteristics (annual 7-day mean low flows at the 2-year and 10-year recurrence intervals 7Q2 and 7Q10, respectively) were also calculated at nine gaging stations by program A969. In this program, a log-Pearson Type III distribution is fitted to a set of observed annual 7-day mean low flows to obtain coordinates of the computed low-flow frequency curve. If the log-Pearson Type III curve did not adequately fit a plot of the observed data, especially in the low end, then a graphical curve was drawn. The graphical curve was used to interpret the observed data when necessary because a graphical curve is the basic curve to use in analyzing the frequency of annual low flows according to Riggs (1971, 1972). The frequency curve for Squannacook River near West Groton is shown in figure 8.

Additional flow data, including flood-frequency analyses, are available from WATSTORE. Peak discharges for selected recurrence intervals for 82 sites in Massachusetts are given in Wandle (1982).

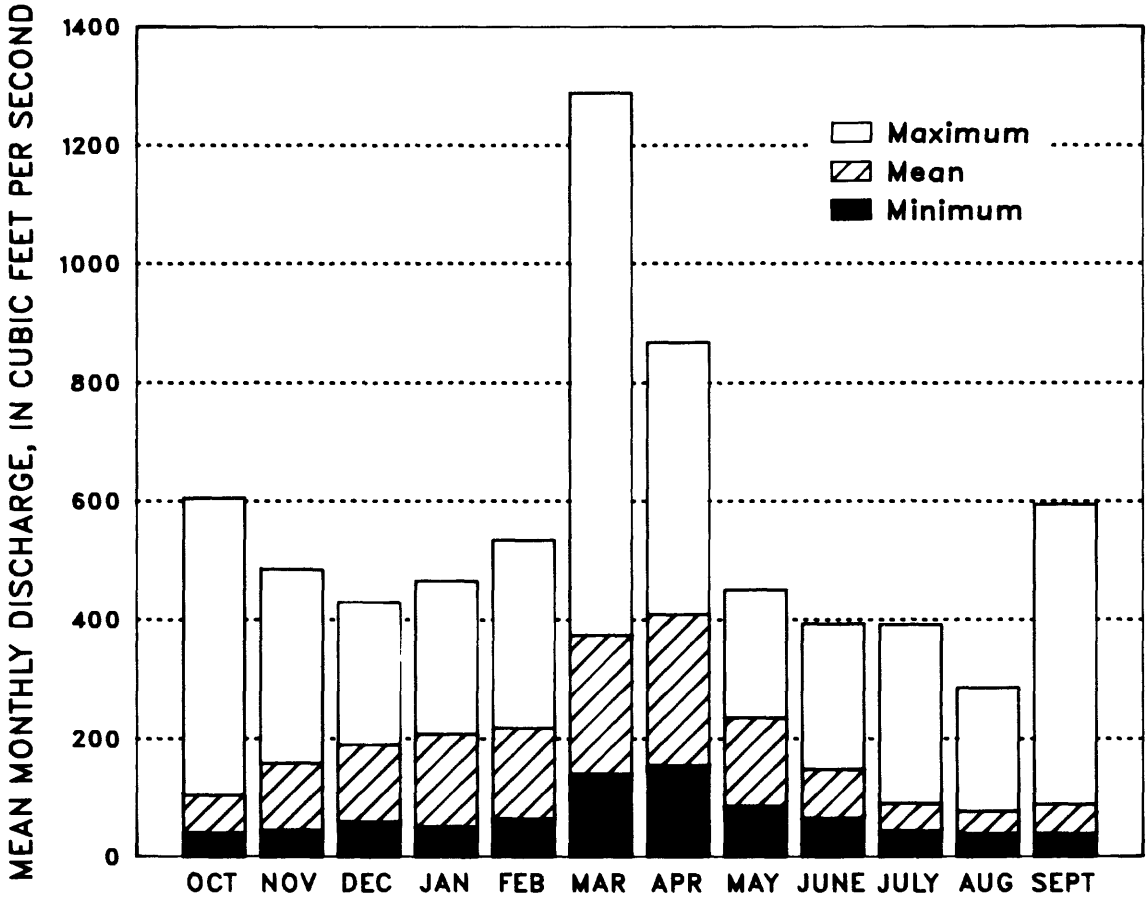


Figure 6.--Monthly discharges and extremes for the North Nashua River near Leominster, Mass.(site 17) during 1936-81

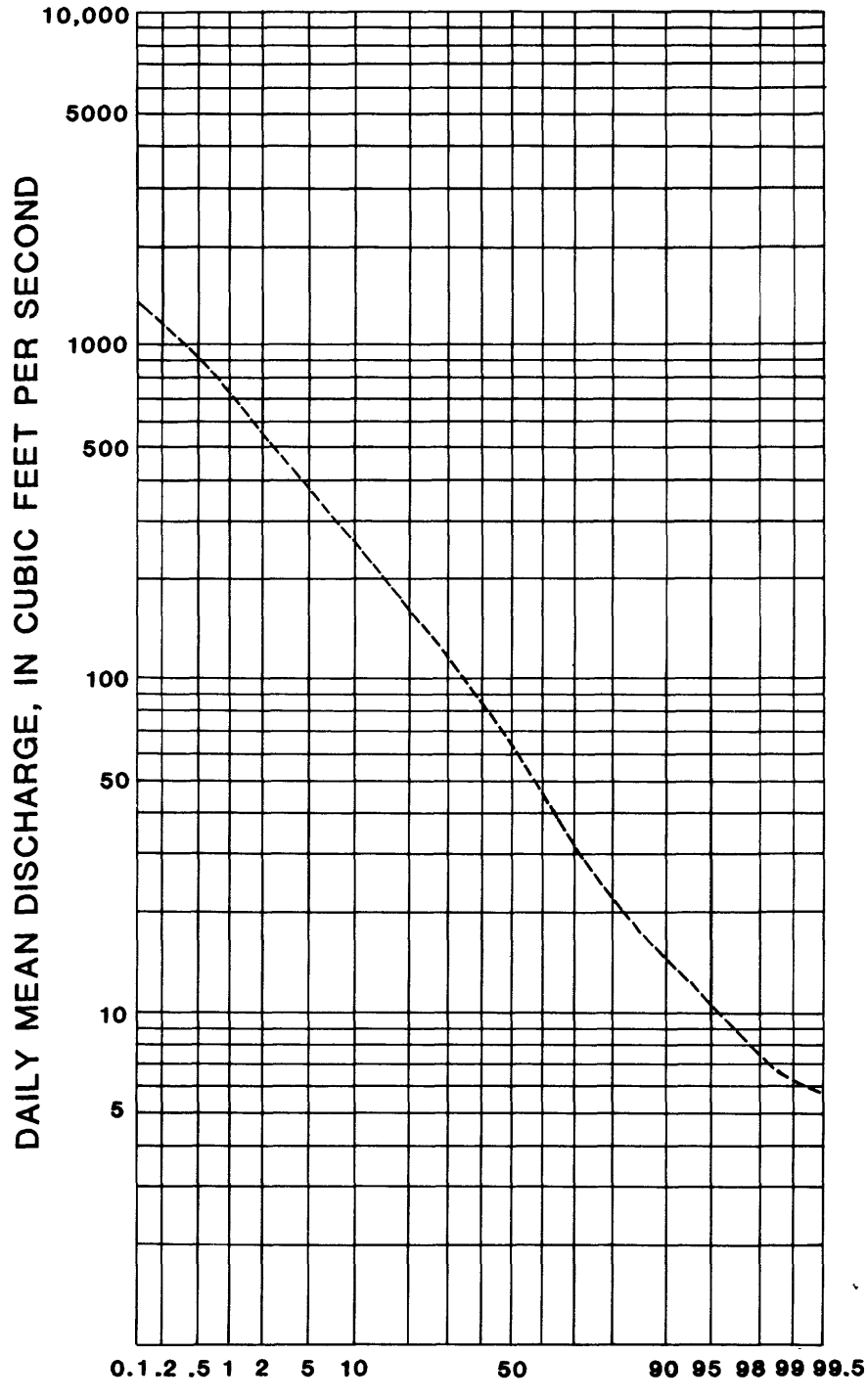


Figure 7.--Flow-duration curves for Squannacook River near West Groton, Mass.(site 49) during 1950-81

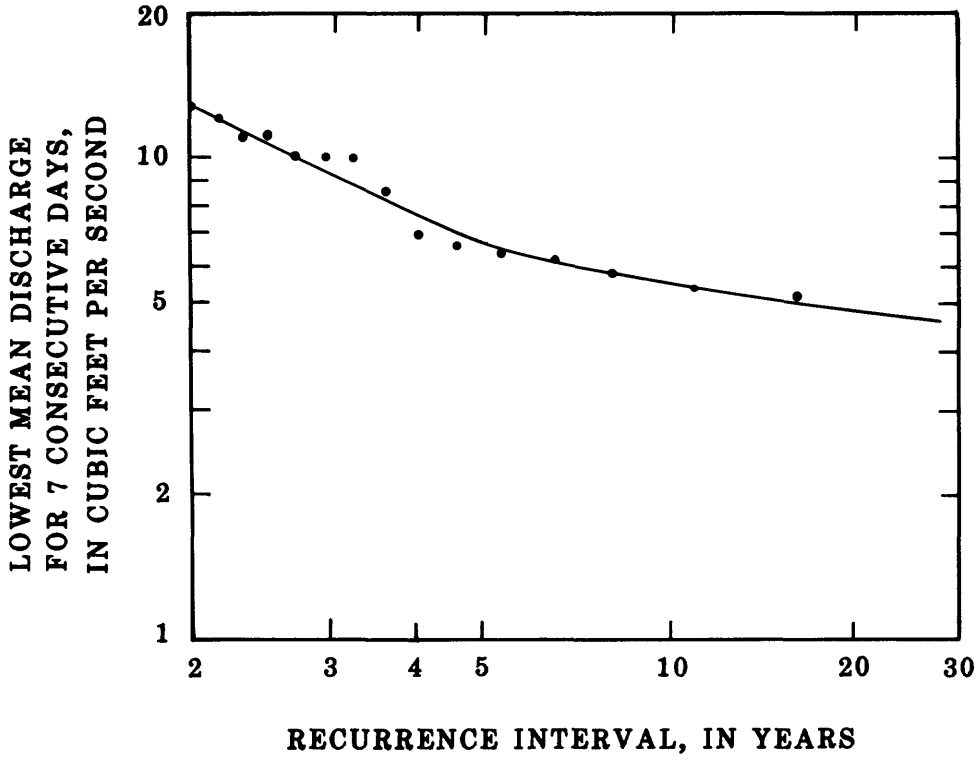


Figure 8.—Low-flow frequency curve for Squannacook River near West Groton, Mass. (site 49) during 1951-81

Characteristics of low flow were also determined at low-flow partial-record stations where measurements of discharge, rather than a continuous daily flow record, were available. This estimating technique is briefly described in the section on Streamflow Analysis. The 7-day low-flow statistics were developed from discharge measurements made during periods of base runoff. Base runoff is defined (Langbein and Iseri, 1960) as "the sustained or fair weather runoff. In most streams, base runoff is composed largely of ground-water effluent." Base runoff usually occurs in most Massachusetts streams during the summer months or early fall after 5 to 7 days without rainfall.

STREAMFLOW ANALYSIS

Streamflow Data Base

Systematic records of daily streamflow have been collected since at least 1936 in the Merrimack River basin. The location and period of record for these gaging stations are given in table 2. Streamflow records are available for the Merrimack River basin within New Hampshire from the U.S. Geological Survey office in Concord, New Hampshire.

Discharge measurements were made at 79 low-flow partial-record and at 81 miscellaneous sites during the water-resources investigations of the Merrimack River basin (Brackley and Hansen, 1977, 1982; Gay and Delaney, 1980a, 1980b). Measurements were also collected as part of the Massachusetts low-flow network at three sites from 1978 to 1981, at six sites during 1965

and 1966, and at 11 sites in the Assabet River basin during 1962-66. Discharge measurements were available for 11 sites as part of the study of nitrogen and phosphorous in the headwaters of Hop Brook during 1977-79 (Briggs and Silvey, 1984).

Flow characteristics are useful in resource management and design studies if these variables represent a particular regulated flow sequence or the natural flow regime that is expected to occur in the future. A valid streamflow analysis is based upon flow records during a period of relatively constant river-basin conditions.

Daily Flow Statistics

Systematic daily flow records available for 20 sites in the Merrimack River basin were reviewed to select a data base for statistical analysis. Impacts of reservoirs, diversions, regulation, and withdrawals for public supplies on streamflows were assessed using information on stream regulation found in the series of water-resources data reports issued annually (see U.S. Geological Survey, 1980, for an example) and in Knox and Soule (1949). Streamflow records for 12 sites were selected that represent a flow regime influenced by fairly constant river-basin conditions (Wandle, 1983). The record length used in this analysis is given in table 4. Low flow, monthly flow, and flow-duration characteristics given in table 4 were derived from the observed streamflow records at each station and were not adjusted for regulation or diversion. These daily streamflow characteristics were computed following procedures summarized in the section on streamflow characteristics.

Low-Flow Statistics

Continuous streamflow records are not necessary to estimate low-flow characteristics at sites. According to Riggs (1972) selected base-flow measurements rather than a continuous daily flow record can define the low-flow characteristics at a site.

Low-flow partial-record stations are operated to collect discharge measurements when streamflow is composed largely of ground-water runoff. These low-flow sites are selected on streams where flow is expected to occur during a significant dry spell and where the flow is not affected by artificial regulation. Base-flow measurements to define a relation with concurrent gaged flows are obtained over several low-flow periods.

A relation is developed with the base-flow measurements and the concurrent daily mean flows at a nearby long-record gaging station (index station). The 7-day low-flow statistics (7Q2 and 7Q10) for the site are determined from this relation using the appropriate low-flow statistics for the gaged stream. This estimating technique is explained in more detail by Riggs (1972).

Low-flow statistics for 79 sites in the Merrimack River basin are summarized in table 5 (at the end of the report). The low-flow statistics are representative of the hydrologic regime during the data-collection period. Seven-day, 2-year, and 10-year low flows ranged from 0 to 0.42 and from 0 to 0.26 $(ft^3/s)/mi^2$, respectively, at these sites. Charles River at Dover, Squannacook River near West Groton, and Quaboag River at West Brimfield were used as index stations. These values were computed following the procedures mentioned above. Low-flow characteristics were not estimated for the miscellaneous measurement sites.

SUMMARY

Drainage areas were re-computed for data-collection sites and were computed for the first time for ungaged streams draining greater than 3 mi^2. Basin characteristics for drainage area, slope, length, elevation, storage, lake area, forest, soil, latitude, longitude, precipitation, precipitation intensity, snowfall, and January minimum temperature are provided for 12 gaged sites in the Merrimack River basin. Computer programs A969 and W4422 were used to determine daily flow statistics including annual and monthly flows, duration of daily flows, and 7-day low-flow values. Seven-day, 2-year, and 10-year low flows ranged from 0 to 0.42 and from 0 to 0.26 $(ft^3/s)/mi^2$, respectively, at the 79 partial-record stations.

Techniques used to compute basin and streamflow characteristics of a river basin are summarized. This gazetteer contains a comprehensive listing of hydrologic characteristics that should prove useful to those concerned with water-resources activities.

Table 1.--Stream-order listing, selected drainage areas, and locations of subbasins within the Merrimack River basin

[Sites with streamflow information listed in tables 2, 4, or 5 are marked with an asterisk. The hierarchical listing is modified from Halliwell and others, 1982. Drainage areas are shown for sites as explained in the section on basin characteristics. These areas are not adjusted for manmade changes in the flow system. Streams entirely in adjacent states are underlined and are included in the list where necessary to maintain the stream order.]

Stream name	Location	Drainage area, in square miles
	NASHUA RIVER BASIN	
Merrimack River		
Nashua River	Mass.-N.H. State line	507
Unkety Brook	River Street	*6.85
Unkety Brook	Lowell Road	4.77
Reedy Meadow Brook	Lowell Road	*1.92
Nissitissit River	Canal Street	*59.6
Nissitissit River	Mass.-N.H. State line	47.9
Nissitissit River	0.2 mile upstream from Pepperell Road	*47.7
Mine Brook		
Sucker Brook		
Beaver Brook		
Gulf Brook	Mass.-N.H. State line	3.64
Stewart Brook		
Stickney Brook (N.H.)		
Wolf Brook		
Nashua River	200 feet downstream from powerplant	*435
Varnum Brook		
Greens Brook		
Nod Brook		
Robinson Brook	Shirley Street	*3.90
Bancroft Brook		
Wrangling Brook		
Dead River		
James Brook	State Route 111	*3.07
Squannacook River	0.2 mile upstream from mouth	*70.8a
Trap Swamp Brook		
Pumpkin Brook		
Squannacook River	0.7 mile downstream from Witch Brook	*63.7a
Witch Brook		
Trout Brook		
Bixby Brook		
Squannacook River	Elm Street	*51.1a
Bayberry Hill Brook		
Mason Brook		
Walker Brook	State Route 124	*5.82
Mason Brook	2200 feet downstream from Mass.-N.H. State line	*9.26
Willard Brook		
Pearl Hill Brook	1800 downstream from Pearl Hill Brook Pond	*5.91
Locke Brook	West Meadow Road	*4.26

Table 1.—Stream-order listing, selected drainage areas, and locations of subbasins within the Merrimack River basin (Continued)

Stream name	Location	Drainage area, in square miles
	NASHUA RIVER BASIN (Continued)	
Merrimack River (Continued)		
Nashua River (Continued)		
Squannacook River (Continued)		
Willard Brook	State Route 119	*12.3a
Trapfall Brook		
Willard Brook	State Route 31	4.53a
Mulpus Brook	Mouth	15.9
Mulpus Brook	State Route 2A	*15.6
Beaver Pond Brook	Mouth	1.31
Mulpus Brook	State Route 225	*10.4
Mulpus Brook	Hickory Hill Lake outlet	7.75
Mulpus Brook	Hickory Hill Lake inlet	5.63
Nonacoicus Brook	200 feet upstream from mouth	*18.9
Willow Brook		
Unnamed tributary		
Cold Spring Brook		
Bowers Brook	Barnum Road	11.8
Bowers Brook	State Route 2	7.64
Long Pond Brook		
Walker Brook		
Morse Brook		
Trout Brook		
Nashua River	Hospital Road	304
Catacoonamug Brook	Mouth	20.0
Catacoonamug Brook	Lancaster Road	*19.1
Bow Brook	Mouth	2.87
Spruce Swamp Brook	Mouth	1.20
Catacoonamug Brook	Lake Shirley outlet	14.2
Easter Brook	Mouth	3.03
Catacoonamug Brook	Hill Road, Lake Shirley inlet	8.55
Still River		
North Nashua River	Mouth	134b
Ponakin Brook		
North Nashua River	600 feet downstream from bridge at Ponakin Mill	*128b
Spectacle Brook		
McGovern Brook		
Unnamed tributary		
Wekepeke Brook	State Route 117	*11.6
Wekepeke Brook	Private road upstream from State Route 12	3.12
Unnamed tributary		
Lynde Brook		
North Nashua River	1.3 miles upstream from Wekepeke Brook	*110b
Fall Brook	Mouth	7.21
Fall Brook	State Route 117	*5.95
Fall Brook	Elm Hill Avenue	*5.84

Table 1.—Stream-order listing, selected drainage areas, and locations of subbasins within the Merrimack River basin (Continued)

Stream name	Location	Drainage area, in square miles
	NASHUA RIVER BASIN (Continued)	
Merrimack River (Continued)		
Nashua River (Continued)		
North Nashua River (Continued)		
Monoosnoc Brook	Mouth	11.4
Monoosnoc Brook	Whitney Street	*11.0
Monoosnoc Brook	Notown Reservoir outlet	4.61
Falulah (Baker) Brook	0.25 mile upstream from mouth	*18.2b
Pearl Hill Brook	Mouth	3.93
Falulah Brook	Pearl Street	*12.0b
Falulah Brook	Lovell Reservoir outlet	5.45b
Scott Brook		
Falulah Brook	Fitchburg Reservoir outlet	2.16
North Nashua River	400 feet upstream from Fifth Street	*63.4
Sand Brook		
North Nashua River	Depot Street	*57.7
Unnamed tributary		
Phillips Brook	800 feet upstream from mouth	*15.7
Phillips Brook	300 feet upstream from McTaggarts Pond inlet	*14.8
Phillips Brook	Potato Hill Road	*11.4
Laws Brook		
Phillips Brook	Whitney Hill Road	*6.83
Brown Brook		
Phillips Brook	Winnekeaag Lake outlet	2.29
Flag Brook	500 feet downstream from railroad	*12.5
Unnamed tributary		
Smith Brook	Meeting House Pond outlet	1.49
Flag Brook	Cody Road	*1.20
Unnamed tributary	400 feet downstream from Wachusett Lake outlet	1.55
Whitman River	State Route 2A	*21.6
Whitman River	Crocker Pond outlet	20.3
Whitman River	Inlet Crocker Pond	18.1
Whitman River	Williams Road	7.54
Whitman River	Lake Wampanoag outlet	2.99
Nashua River	Upstream from North Nashua River	132
Nashua River	Mill Street	*130
Unnamed tributary		
Goodridge Brook		
South Meadow Brook	Coachlace Pond outlet	4.60
Nashua River	Wachusett Reservoir outlet	*119
French Brook		
Potash Brook		
Malagasco Brook		
Muddy Brook		

Table 1.—Stream-order listing, selected drainage areas, and locations of subbasins within the Merrimack River basin (Continued)

Stream name	Location	Drainage area, in square miles
	NASHUA RIVER BASIN (Continued)	
Merrimack River (Continued)		
Nashua River (Continued)		
Gates Brook	State Route 140	*2.78
Scarletts Brook		
Malden Brook		*1.26
Quinapoxet River	Shaft No. 1	55.4
Trout Brook	Manning Street	*6.79
Ball Brook		
Governor Brook		
Cold Brook		
Unnamed tributary		
Chaffins Brook	Mouth	7.09
Unnamed tributary		
Poor Farm Brook		
Asnebumskit Brook	Mills Street	*12.9
Warren Tannery Brook		
Asnebumskit Brook	State Route 122A	*10.6
Unnamed tributary		
Bumbo Brook		
Turkey Brook		
Worcester Brook		
Quinapoxet River	Mills Street	*21.7
Quinapoxet River	Quinapoxet Reservoir outlet	19.7
Unnamed tributary	Maple Spring Pond outlet	1.58
Unnamed tributary	Mouth	2.04
Muschopauge Brook	Mouth	4.00
South Wachusett Brook	Mouth	10.5
Wachusett Brook	Downstream from Cobb Brook	10.3
Cobb Brook	Mouth	2.50
South Wauchusett Brook	Calamint Hill Road	5.25
Stillwater River		
Waushacum Brook	Prescott Street	*7.42
Waushacum Brook	West Waushacum Pond outlet	*4.98
Connelly Brook		
Unnamed tributary	East Waushacum Pond outlet	1.22
Stillwater River	Muddy Pond Road	*31.6
Houghton Brook		
Scanlon Brook		
Stillwater River	State Route 62	*26.9
Ball Brook		
Wilder Brook		
East Wachusett Brook	State Route 140	13.3
Babcock Brook		
East Wachusett Brook	State Route 31	3.31
Rocky Brook	150 feet downstream from Beaman Road	*1.95
Bailey Brook		

Table 1.—Stream-order listing, selected drainage areas, and locations of subbasins within the Merrimack River basin (Continued)

Stream name	Location	Drainage area, in square miles
	NASHUA RIVER BASIN (Continued)	
Merrimack River (Continued)		
Nashua River (Continued)		
Stillwater River (Continued)		
Justice Brook		
Bartlett Pond Brook		
Steam Mill Brook		
Keys Brook	State Route 140	4.61
Washburn Brook		
Lamson Brook		
	CONCORD RIVER BASIN	
Concord River	0.8 mile upstream from mouth	*400
(Pawtucket Canal)		
River Meadow Brook	Plain Street	*25.7
Beaver Brook	Mouth	5.59
Putnam Brook		
Farley Brook		
River Meadow Brook	Russell Millpond at State Route 4	9.76
Unnamed tributary		
Pond Brook		
Marginal Brook		
Concord River	U.S. Route 3	361
Unnamed tributary		
Pages Brook	Mouth	3.96
Mill Brook	Mouth	3.14
Sawmill Brook	Mouth	2.66
Mill Brook	Mouth	3.38
Assabet River	Mouth	177
Dakins Brook		
Unnamed tributary		
Spencer Brook	Angiers Pond outlet	5.87
Unnamed tributary	Mouth	47.3
Fort Pond Brook		
Nashoba Brook	150 feet upstream from mouth	*21.7
Nagog Brook		
Nashoba Brook	1500 feet downstream from dam at North Acton	*12.8
Butter Brook		
Nonset Brook		
Vine Brook		
Fort Pond Brook	Upstream from Nashoba Brook	*24.9
Heath Hen Meadow Brook	Mouth	6.05
Heath Hen Meadow Brook	West Acton Road	*3.83
Fort Pond Brook	State Route 111	12.1
Guggins Brook	Liberty Square Road	*1.77
Inch Brook		

Table 1.—Stream-order listing, selected drainage areas, and locations of subbasins within the Merrimack River basin (Continued)

Stream name	Location	Drainage area, in square miles
	CONCORD RIVER BASIN (Continued)	
Merrimack River (Continued)		
Concord River (Continued)		
Assabet River (Continued)		
Unnamed tributary		
Second Division Brook	Mouth	2.00
Assabet River	State Route 27	*116
Taylor Brook	Mouth	4.22
Assabet Brook	Mouth	20.0
Elizabeth Brook	State Route 62	17.9
Great Brook	East End Road	5.17
Boulder Brook	900 feet downstream from Interstate 495	*1.60
Boulder Brook	Brown Road	*1.32
Elizabeth Brook	Interstate Route 495	4.07
Unnamed tributary	Boons Pond outlet	1.89
Fort Meadow Brook	Chestnut Street	*5.29
Flagg Brook		
Sheep Fall Brook		
Assabet River	Cox Street	*73.7
Unnamed tributary		
Danforth Brook	Cox Street	*6.59
Mill Brook	Mill Road	*4.44
Unnamed tributary		
Hog Brook		
Gates Pond Brook		
North Brook	Mouth	17.1
Barefoot Brook		
North Brook	Whitney Street	*15.5
Cooledge Brook		
North Brook	Jones Road	*11.0
North Brook tributary	State Route 62	*8.28
Assabet River	Hudson Street	39.2
Unnamed tributary	Millham Reservoir outlet	3.78
North Branch Brook		
Millham Brook		
Stirrup Brook	Mouth	4.52
Howard Brook	Upstream from railroad	*7.53
Howard Brook	Whitney Street	*2.69
Cold Harbor Brook	Mouth	6.85
Unnamed tributary		
Rawson Hill Brook	Reservoir Street	*2.04
Hop Brook	Mouth	7.88
Little Bummet Brook		
Assabet River	Fisher Street	*7.10
Sudbury River	Mouth	162
Dugan Brook		

Table 1.--Stream-order listing, selected drainage areas, and locations of subbasins within the Merrimack River basin (Continued)

Stream name	Location	Drainage area, in square miles
	CONCORD RIVER BASIN (Continued)	
Merrimack River (Continued)		
Concord River (Continued)		
Sudbury River	State Route 117	155
Pantry Brook	Mouth	6.82
Cold Brook		
Unnamed tributary	Mouth	6.82
Hazel Brook		
Bridge Brook		
Sudbury River	U.S. Route 20	138
Wash Brook	Landham Road	*21.4
Hop Brook	Confluence with Landham Brook	15.7
Dudley Brook		
Hop Brook	Peakham Road	*11.7
Run Brook		
Hager Pond outlet	Outlet	*1.80
Landham Brook	Upstream from Hop Brook	4.45
Hop Brook		
Pine Brook	Mouth	5.82
Unnamed tributary		
Mill Brook		
Hayward Brook	U.S. Route 20	*2.31
Sudbury River	Danforth Street	*105
Lake Cochituate outlet	140 feet downstream from dam	*21.1
Snake Brook	State Route 27	*2.10
Unnamed tributary	150 feet downstream from Fisk Pond	11.5
Pegan Brook	150 feet upstream from Lake Cochituate	*.54
Course Brook	Pond Street	*3.44
Beaverdam Brook	Mill Street	*7.27
Beaverdam Brook	Boden Lane	*6.47
Dunsdell Brook		
Eames Brook		
Baiting Brook	Mouth	3.39
Birch Meadow Brook		
Sudbury River	Reservoir No. 1 outlet	74.8
Unnamed tributary		
Willow Brook		
Angelica Brook	Mouth	1.67
Stony Brook	Sudbury Reservoir outlet	22.5
Mowry Brook	Mouth	1.45
North Branch		
Broad Meadow Brook	Mouth	.95
Cowassock Brook		
Cold Spring Brook	Chestnut Street	7.99
Cold Spring Brook	Spring Street	5.44

Table 1.—Stream-order listing, selected drainage areas, and locations of subbasins within the Merrimack River basin (Continued)

Stream name	Location	Drainage area, in square miles
	CONCORD RIVER BASIN (Continued)	
Merrimack River (Continued)		
Concord River (Continued)		
Sudbury River	Fountain Street	*35.1
Indian Brook	Mouth	7.88
Indian Brook	Hopkinton Reservoir outlet	6.44
Indian Brook	100 feet downstream from State Route 85	5.25
Sudbury River	200 feet downstream from Fruit Street	*19.2
Whitehall Brook	Mouth	7.33
Piccadilly Brook	Westborough Reservoir outlet	1.21
Jackstraw Brook		
Rutters Brook		
Jackstraw Brook	Upstream from Rutters Brook	2.69
Denny Brook		
Jackstraw Brook	Hopkinton Road	*1.34
Jackstraw Brook	Upton Road	*1.19
	SHAWSHEEN RIVER BASIN	
Shawsheen River	500 feet downstream from railroad bridge	*78.0
Shawsheen River	100 feet north of Andover-Lawrence town line	*75.3
Hussey Brook		
Shawsheen River	State Route 28	*71.0
Shawsheen River	Essex Road	*70.6
Rogers Brook		
Shawsheen River	Horn Road	*68.9
Bakers Meadow Reservoir outlet	Arguila Road	*.80
Shawsheen River	Road 1.2 miles downstream from Interstate 93	65.4
Shawsheen River	Interstate Route 93	*60.7
Shawsheen River trib. No. 2	Shawsheen Street	*.37
Shawsheen River tributary	Old Railroad Grade	*3.03
Shawsheen River tributary	South Street	*2.88
Shawsheen River	Mill Street	*55.5
Strong Water Brook	Shawsheen Street	*9.27
Meadow Brook	Pinnable Street	*4.08
Meadow Brook	Kendall Street	*1.52
Shawsheen River	State Route 38	*45.8
Shawsheen River trib. No. 4	Brown Street	*.19
Heath Brook	Shawsheen Street	*2.14
Content Brook	Whipple Road	*5.21
Shawsheen River	State Route 129	*36.5
Shawsheen River	Town of Burlington Water Department intake	*35.4
Jones Brook		
Webb Brook		
Shawsheen River	State Route 3A	*31.1
Beaver Brook	Mouth	.05
McKee Brook		

Table 1.—Stream-order listing, selected drainage areas, and locations of subbasins within the Merrimack River basin (Continued)

Stream name	Location	Drainage area, in square miles
	SHAWSHEEN RIVER BASIN (Continued)	
Merrimack River (Continued)		
Shawsheen River	Middlesex Turnpike	*27.2
Vine Brook	State Route 62	*9.94
Sandy Brook		
Long Meadow Brook		
Vine Brook	Butterfield Pond outlet	3.37
Spring Brook	200 feet upstream from mouth	*2.25
Shawsheen River	Page Road	*13.7
Shawsheen River	800 feet upstream from Page Road	*13.3
Elm Brook	Great Road	*5.88
Shawsheen River	Great Road	*7.13
Shawsheen River	Summer Street	*6.55
Kiln Brook		
	LOWER MERRIMACK DRAINAGE BASIN	
Merrimack River	Mouth	5014
Plum Island River (connects to Plum Island Sound)		
Plumbush Creek		
Black Rock Creek		
Allen Creek		
Shad Creek		
Morrill Creek		
Merrimack River	State Route 1A	5005
Back River		
Town Creek		
Powwow River	Mouth	58.7
Unnamed tributary		
Back River		
Unnamed tributary	Congress Street	.80
Back River	Fern Avenue	*5.14
Lucy Brook		
Powwow River	Mass.-N.H. State line	41.4
Unnamed tributary		
Back River		
Goodwin Creek		
Artichoke River	Lower Artichoke Reservoir outlet	6.02
Upper Artichoke Reservoir trib.	Garden Street	*1.40
Upper Artichoke Reservoir trib.	Indian Hill Street	*.91
Indian River	Main Street	*1.43
Sawmill Brook	Stewart Street	*.52
Cobbler Brook	East Main Street	*2.46
Cobbler Brook	Highland Street	*.75
Merrimack River	Rocks Bridge	4919
Unnamed tributary		
East Meadow River	Mouth	9.73
East Meadow River	State Route 110	*5.47

Table 1.—Stream-order listing, selected drainage areas, and locations of subbasins within the Merrimack River basin (Continued)

Stream name	Location	Drainage area, in square miles
LOWER MERRIMACK DRAINAGE BASIN (Continued)		
Merrimack River (Continued)		
Unnamed tributary	East Broadway	.53
Johnson Creek	Mouth	9.49
Johnsons Pond tributary	Center Street	*3.03
Little River	Mouth	30.4
Snows Brook	Greenleaf Road	*4.01
Snows Brook	Newton Road	.88
Little River	Rosemont Street	*22.8
Fishin Brook	Hilldale Avenue	*.96
Little River	300 feet upstream from Mass.-N.H. State line	21.1
Camp Brook		
Foote Brook		
Creek Brook		
West Meadow Brook	Forest Street	*1.43
Bare Meadow Brook	Brookline Avenue	*7.68
Hawkes Brook	Powerline	*4.35
Hawkes Brook	North Street	*1.40
Bare Meadow Brook tributary	25 feet upstream from State Route 113	*1.04
Unnamed tributary	0.2 mile downstream from Sutton Pond outlet	7.35
Merrimack River	Downstream from Shawsheen River	4828
Spicket River	Mouth	77.6
Spicket River	General Street	*77.5
Spicket River	Dam 3.2 miles upstream from mouth	*73.8
World End Brook		
Harris Brook	Cross Street	*4.90
Spicket River	Hampshire Road	*62.1
Merrimack River	Interstate 93	4666
Unnamed tributary		
Bartlett Brook	Lowell Street	*6.83
Bartlett Brook	Salem Road	*1.71
Sawyer Brook		
Griffin Brook		
Fish Brook	River Road	*3.59
Nickle Mine Brook		
Trull Brook	River Road	*4.40
Richardson Brook	Methuen Street	*4.22
Trout Brook	Wheeler Road	*.70
Merrimack River	1100 feet downstream from Concord River	*4635
Concord River		
Beaver Brook	Mouth	94.9
Peppermint Brook		
Double Brook		
Beaver Brook	1000 feet downstream Mass.-N.H. State line	*86.8
Merrimack River	Lowell water-treatment plant	*4129

Table 1.--Stream-order listing, selected drainage areas, and locations of subbasins within the Merrimack River basin (Continued)

Stream name	Location	Drainage area, in square miles
	STONY BROOK BASIN	
Merrimack River (Continued)		
Stony Brook	Mouth	45.6
Cold Springs Brook		
Stony Brook	Twiss Road	*43.6
Crooked Springs Brook		
Gilson Brook	Mouth	3.55
Unnamed tributary		
Blue Brook		
Tadmuck Brook		
Keyes Brook	Mouth	6.14
Snake Meadow Brook		
Coldspring Brook		
Boutwell Brook		
Reed Brook		
Stony Brook	Town Farm Road	*23.8
Beaver Brook	Beaver Brook Road	13.4
Gilson Brook	Mouth	7.13
Bennetts Brook		
	LOWER MERRIMACK DRAINAGE BASIN	
Deep Brook	Mouth	2.47
Scarlet Brook		
Lawrence Brook	State Route 113	3.37
Unnamed tributary		
Bridge Meadow Brook	Flint Pond outlet	7.60
Limit Brook		
	SALMON BROOK BASIN	
Salmon Brook	Mass.-N.H. State line	22.7
Joint Grass Brook		
Salmon Brook	Main Street	*18.2
Hauk Brook		
Black Brook		
Cow Pond Brook	Wharf Road	*8.44
Baddacook Brook		
Unnamed tributary		
Martins Pond Brook		
	SOUHEGAN RIVER BASIN	
Souhegan River (N.H.)		
South Branch Souhegan River	Mass.-N.H. State line	8.68
Unnamed tributary	Ward Pond outlet	3.73

a Excludes 2.16 mi^2 above outlet of Fitchburg Reservoir.
b Includes 2.16 mi^2 above outlet of Fitchburg Reservoir.

Table 2.—Summary of daily flow records available in the Merrimack River basin

Number in figures 2-5	Station number	Station name	Location	Period of record	Remarks
10	01094400	North Nashua River at Fitchburg, Mass.	400 feet upstream from Fifth Street	1973-81	Regulated by mills and reservoirs. Diversions for municipal use.
17	01094500	North Nashua River near Leominster, Mass.	1.3 miles upstream from Wekepeke Brook	1936-81	Regulated at low flow by mills. Flow includes diversion to basin for municipal supplies, for Fitchburg from Mare Meadow Reservoir since 1955, for Leominster from Wachusett Reservoir since 1966, and for the Southeast Well Field since 1958.
19	01094700	North Nashua River near Lancaster, Mass.	600 feet downstream from bridge at Ponakin Mill	1969-74	Water-quality monitor. Discontinued.
24	01095000	Rocky Brook near Sterling, Mass.	150 feet downstream from Beamon Road	1947-67	Regulated by reservoir since 1949. Discontinued.
26	01095200	Houghton Brook near Oakdale, Mass.	State Route 140	1964-81	Peak-flow site.
34	01095500	Nashua River at Clinton, Mass.	Wachusett Dam	1897-1981	Regulated by Wachusett Reservoir and several ponds. Records adjusted for change in contents in and wastage from Wachusett Reservoir and diversions from Ware River and Quabbin Reservoir. Entire flow diverted for Boston metropolitan district and other municipalities. Monthly discharges only.
37	01095800	Easter Brook near North Leominster, Mass.	Lancaster Ave.	1964-74	Peak-flow site. Discontinued.

Table 2.—Summary of daily flow records available in the Merrimack River basin (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Remarks
49	01096000	Squannacook River near West Groton, Mass.	0.7 mile downstream from Witch Brook	1950-81	Occasional regulation at low flow, greater prior to 1961. Flow from Ashby Reservoir diverted for municipal supply of Fitchburg except during 1964, 1967-81.
53	01096500	Nashua River at East Pepperell, Mass.	200 feet downstream from powerplant	1936-81	Regulated by powerplant. Flow includes water released while diverting flow of Nashua River for Boston metropolitan district, water diverted into basin from Ware River since 1955 for municipal use of Fitchburg and water diverted through powerplant. Water-quality records 1952-53, 1973-74.
62	01096550	Merrimack River above Lowell, Mass.	Lowell water-treatment plant	1973	Water-quality monitor. Discontinued.
63	01096570	Merrimack River above Concord River at Lowell, Mass.	Pawtucket Dam	1968-72	Water-quality records. Discontinued.
80	01096906	Boulder Brook near East Bolton, Mass.	Brown Road	1976-78	Discontinued. Water-quality records 1972-78.
81	01096910	Boulder Brook at East Bolton, Mass.	900 feet downstream from Interstate Route 495	1972-81	Daily and monthly figures may be influenced by stored or released water at trash screen just upstream. Water-quality records 1972-78.
84	01097000	Assabet River at Maynard, Mass.	150 feet upstream from State Route 27	1942-81	Occasional diurnal fluctuation at low flow, greater prior to 1969. High flow affected by retarding reservoirs since 1970. Occasional release at low flow since 1970 from these reservoirs.

Table 2.—Summary of daily flow records available in the Merrimack River basin (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Remarks
87	01097200	Heath Hen Meadow Brook at Stow, Mass.	West Acton Road	1964-74	Peak-flow site. Discontinued.
89	01097300	Nashoba Brook near Acton, Mass.	1500 feet downstream from dam	1964-81	Occasional regulation since 1967. Water-quality records 1972-74, 1976-77.
94	01097450	Jackstraw Brook at Hopkinton Road, Westborough, Mass.	Hopkinton Road	1964-81	Peak-flow site.
98	01098320	Beaverdam Brook at Natick, Mass.	Mill Street	1978-79	Discontinued.
99	01098340	Course Brook at Natick, Mass.	Pond Street	1978-79	Discontinued.
100	01098360	Pegan Brook at Natick, Mass.	150 feet upstream from Lake Cochituate	1978-79	Discontinued.
101	01098450	Snake Brook at Wayland, Mass.	10 feet upstream from State Route 27	1978-79	Discontinued.
102	01098500	Lake Cochituate Outlet at Framingham, Mass.	140 feet downstream from dam	1978-79	Regulated by Lake Cochituate. Discontinued.
104	01098530	Sudbury River at Saxonville, Mass.	Danforth Street	1980-81	Regulated by reservoirs. Flow affected by diversions and spill. Diversions as needed for Boston metropolitan supply. Diversions from Wachusett Reservoir.
105	01098700	Hayward Brook at Wayland, Mass.	U.S. Route 20	1964-74	Peak-flow site.
111	01098710	Hager Pond outlet at Marlborough, Mass.	Hager Pond outlet	1977-79	Diversion for city of Marlborough sewage-treatment plant. Discontinued.

Table 2.—Summary of daily flow records available in the Merrimack River basin (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Remarks
121	01099500	Concord River below River Meadow Brook at Lowell, Mass.	300 feet downstream from Rogers Street	1936-81	Discharge includes water released from Sudbury River basin and Lake Cochituate. Diversions for city of Lowell prior to December 1961. Low flow regulated by mills.
122	01100000	Merrimack River below Concord River at Lowell, Mass.	1100 feet downstream from Concord River	1924-81	Discharge includes water released from Sudbury and Nashua River basins and Lake Cochituate. Regulated by powerplants, by Franklin Falls Reservoir (New Hampshire) since 1942, and by Squam, Newfound, Winnipesaukee, Winnisquam, and other lakes in New Hampshire. Water-quality records 1954, 1966-74.
124	01100100	Richardson Brook near Lowell, Mass.	Methuen Street	1963-81	Peak-flow site.
146	01100600	Shawsheen River near Wilmington, Mass.	State Route 129	1964-81	Diversion at times each year since 1973 for municipal supply of Burlington.
186	01100700	East Meadow River near Haverhill, Mass.	State Route 110	1964-74	Discontinued.
187	01100750	Merrimack River at West Newbury, Mass.	Bridge Street	1968-76	Water-quality records. Discontinued.
188	01100800	Cobbler Brook near Merrimack, Mass.	Highland Street	1963-81	Peak-flow site.

Table 3.—Basin characteristics for stream-gaging stations in the Merrimack River basin

Basin characteristics	Station name and site number				
	North Nashua River at Fitchburg, Mass. (10)	North Nashua River near Leominster, Mass. (17)	Rocky Brook near Sterling, Mass. (24)	Houghton Brook near Oakdale, Mass. (26)	Easter Brook near North Leominster, Mass. (37)
Area, in square miles	63.4	a110	1.95	0.69	0.92
Slope, in feet per mile	—	40.7	—	27.8	114
Length, in miles	—	22.7	—	1.2	1.4
Elevation, in feet	—	870	—	550	470
Storage, in percent	—	3.76	—	12.8	4.78
Lake area, in percent	—	3.30	—	.0	.0
Forest, in percent	—	72	—	65	50
Soils index, in inches	—	5.2	—	5.3	5.7
Latitude of gage, in decimal degrees	42.5761	42.5000	42.4492	42.4158	42.5500
Longitude of gage, in decimal degrees	71.7886	71.7200	71.8028	71.8033	71.7100
Precipitation, in inches	—	44.5	—	44.0	42.0
Precipitation intensity for 2-year recurrence interval, in inches	—	3.2	—	3.0	3.0
Snowfall, in inches	—	65	—	60	60
January minimum temperature, in degrees Fahrenheit	—	14	—	16	16

a Includes 2.16 mi^2 above outlet of Fitchburg Reservoir.

Table 3.—Basin characteristics for stream-gaging stations in the Merrimack River basin (Continued)

Basin characteristics	Station name and site number				
	Squannacook River near West Groton, Mass. (49)	Nashua River at East Pepperell, Mass. (53)	Boulder Brook at East Bolton, Mass. (81)	Assabet River at Maynard, Mass. (84)	Heath Hen Meadow Brook at Stow, Mass. (87)
Area, in square miles	b63.7	c435	1.60	116	3.83
Slope, in feet per mile	43.6	10.0	—	5.86	12.1
Length, in miles	15.0	49.5	—	24.1	4.10
Elevation, in feet	650	650	—	350	290
Storage, in percent	5.21	—	—	—	4.50
Lake area, in percent	1.20	3.71	—	1.77	1.00
Forest, in percent	89	75	—	76	74
Soils index, in inches	6.0	4.3	—	4.4	4.4
Latitude of gage, in decimal degrees	42.6300	42.6675	42.4511	42.4319	42.4500
Longitude of gage, in decimal degrees	71.6600	71.5756	71.5775	71.4503	71.5000
Precipitation, in inches	43.0	43.5	—	42.2	42.0
Precipitation intensity for 2-year recurrence interval, in inches	3.0	3.0	—	2.9	3.0
Snowfall, in inches	63	62	—	55	55
January minimum temperature, in degrees Fahrenheit	14	14	—	17	17

b Excludes 2.16 mi^3 above outlet of Fitchburg Reservoir.
c Includes 119 mi^2 above Wachusett Reservoir.

Table 3.—Basin characteristics for stream-gaging stations in the Merrimack River basin (Continued)

Basin characteristics	Station name and site number				
	Nashoba Brook near Acton, Mass. (89)	Jackstraw Brook at Hopkinton Road, Westborough, Mass. (94)	Hayward Brook at Wayland, Mass. (105)	Hager Pond Outlet at Marlborough, Mass. (111)	Concord River below River Meadow Brook at Lowell, Mass. (121)
Area, in square miles	12.8	1.19	2.31	1.80	d400
Slope, in feet per mile	22.6	133	19.7	—	5.00
Length, in miles	6.5	2.4	1.1	—	46.6
Elevation, in feet	230	500	180	—	270
Storage, in percent	4.54	2.15	19.1	—	—
Lake area, in percent	.60	.0	.44	—	3.05
Forest, in percent	77	61	61	—	71
Soils index, in inches	4.4	4.2	4.2	—	4.3
Latitude of gage, in decimal degrees	42.5100	42.2539	42.3611	42.4511	42.6367
Longitude of gage, in decimal degrees	71.4100	71.6039	71.3475	71.5775	71.3025
Precipitation, in inches	41.0	44.0	42.0	—	42.5
Precipitation intensity for 2-year recurrence interval, in inches	3.0	3.3	3.0	—	2.8
Snowfall, in inches	60	50	60	—	57
January minimum temperature, in degrees Fahrenheit	18	17	17	—	18

d Total area above station.

Table 3.—Basin characteristics for stream-gaging stations in the Merrimack River basin (Continued)

Basin characteristics	Station name and site number				
	Merrimack River below Concord River at Lowell, Mass. (122)	Richardson Brook near Lowell, Mass. (124)	Shawsheen River near Wilmington, Mass. (146)	East Meadow Brook near Haverhill, Mass. (186)	Cobbler Brook near Merrimack, Mass. (188)
Area, in square miles	d4635	4.22	36.5	5.47	0.75
Slope, in feet per mile	—	50.0	4.76	18.4	64.8
Length, in miles	—	2.8	11.2	2.90	1.40
Elevation, in feet	—	170	160	140	210
Storage, in percent	—	2.30	7.1	11.1	.0
Lake area, in percent	—	.01	.40	.83	.0
Forest, in percent	—	58	39	74	81
Soils index, in inches	—	3.8	4.5	3.8	4.2
Latitude of gage, in decimal degrees	42.6458	42.6633	42.5681	42.8114	42.8486
Longitude of gage, in decimal degrees	71.2989	71.2672	71.2153	71.0331	71.0194
Precipitation, in inches	—	40.0	41.0	40.0	40.0
Precipitation intensity for 2-year recurrence interval, in inches	—	3.0	3.0	3.0	3.0
Snowfall, in inches	—	60	60	55	55
January minimum temperature, in degrees Fahrenheit	—	17	20	17	17

d Total area above station.

Table 4.—Streamflow characteristics, in cubic feet per second, at selected stream-gaging stations

Annual and monthly flow characteristics:

QA is the mean annual discharge

SDQA is the standard deviation of mean annual discharge

QM is the mean discharge for M calendar month, M = 1 for January where the top line is the maximum mean; the middle line is the mean; the bottom line is the minimum mean

SDQM is the standard deviation of mean discharge for M calendar month

Low-flow characteristics:

7Q2 is the annual minimum 7-day mean discharge for 2-year recurrence interval

7Q10 is the annual minimum 7-day mean discharge for 10-year recurrence interval

Flow-duration characteristics:

DPT is the daily discharge, exceeded PT percent of the time, from the flow-duration curve

Years of record:

YRSDAY is the number of years of daily flow record for this analysis

YRSLOW is the number of years of low-flow record for this analysis

Flow	Station name and site number					
	North Nashua River at Fitchburg, Mass. (10)	North Nashua River at Leominster, Mass. (17)	Rocky Brook near Sterling, Mass. (24)	Squannacook River near West Groton, Mass. (49)	Nashua River at East Pepperell, Mass. (53)	Boulder Brook at East Bolton, Mass. (80)
ANNUAL						
QA	—	191	3.48	109	558	3.16
SDQA	—	48.7	1.37	32.0	166	.93
MONTHLY						
Q10	182	606	13.4	296	1356	4.71
	—	105	3.06	50.5	287	1.45
	24.7	39.4	.04	9.41	91.1	.19
SDQ10	—	97.5	3.76	60.9	249	1.59
Q11	219	485	11.9	304	1781	5.83
	—	159	3.87	91.9	444	2.52
	31.3	44.4	.23	12.6	108	.38
SDQ11	—	107	3.54	76.9	348	2.40

Table 4.—Streamflow characteristics, in cubic feet per second, at selected stream-gaging stations (Continued)

Flow	Station name and site number					
	North Nashua River at Fitchburg, Mass. (10)	North Nashua River at Leominster, Mass. (17)	Rocky Brook near Sterling, Mass. (24)	Squannacook River near West Groton, Mass. (49)	Nashua River at East Pepperell, Mass. (53)	Boulder Brook at East Bolton, Mass. (80)
MONTHLY (Continued)						
Q12	284	429	10.4	261	1504	6.05
	—	190	4.14	114	554	3.34
	43.6	58.6	.54	22.7	134	.47
SDQ12	—	105	2.78	67.9	336	2.20
Q1	262	465	9.74	323	1417	11.7
	—	208	4.33	121	590	4.41
	24.6	50.3	.41	20.1	116	.27
SDQ1	—	114	2.56	77.4	353	3.48
Q2	276	534	9.28	328	1544	9.48
	—	218	4.06	125	638	4.34
	34.6	63.7	1.56	33.6	186	.90
SDQ2	—	110	2.23	74.4	339	2.49
Q3	396	1289	10.2	419	3930	11.9
	—	374	6.58	223	1135	7.30
	122	140	3.31	84.0	446	4.73
SDQ3	—	183	2.36	86.4	558	2.63
Q4	302	868	14.2	520	2358	13.2
	—	409	7.60	283	1214	6.71
	124	154	1.26	103	444	4.23
SDQ4	—	178	4.11	111	531	2.81
Q5	224	450	8.84	343	1382	7.48
	—	235	3.89	144	707	4.02
	75.7	85.4	.89	51.9	236	1.56
SDQ5	—	99.1	2.32	62.8	301	1.94
Q6	104	393	4.08	173	1068	4.73
	—	148	1.49	66.7	435	1.82
	39.9	64.3	.20	21.0	154	.38
SDQ6	—	77.1	1.10	39.0	234	1.26

Table 4.—Streamflow characteristics, in cubic feet per second, at selected stream-gaging stations (Continued)

Flow	Station name and site number					
	North Nashua River at Fitchburg, Mass. (10)	North Nashua River at Leominster, Mass. (17)	Rocky Brook near Sterling, Mass. (24)	Squannacook River near West Groton, Mass. (49)	Nashua River at East Pepperell, Mass. (53)	Boulder Brook at East Bolton, Mass. (80)
MONTHLY (Continued)						
Q7	82.8	392	4.24	84.7	1366	1.83
	—	90.0	.71	34.8	257	.68
	30.5	42.9	.03	8.26	90.0	.07
SDQ7	—	56.1	1.09	23.0	204	.59
Q8	71.1	286	3.66	57.4	966	2.77
	—	76.8	.58	25.2	206	.54
	21.9	38.1	.01	6.21	71.3	.04
SDQ8	—	39.1	.88	13.8	149	.76
Q9	101	595	8.94	245	1671	2.35
	—	89.2	1.58	31.7	239	.71
	16.1	38.2	.02	6.80	84.2	.06
SDQ9	—	93.8	2.42	43.2	283	.77
LOW FLOW						
7Q2	—	45.4	.05	12.9	93.3	—
7Q10	—	35.3	.00	5.5	46.0	—
FLOW DURATION						
D99	15.5	34.0	.02	6.2	7.8	.04
D95	23.6	43.8	.04	10.6	35.4	.10
D90	29.0	49.5	.07	14.2	89.4	.15
D75	40.7	67.3	.39	24.5	171	.39
D70	45.5	74.2	.62	29.5	196	.55
D50	78.9	122	2.0	63.1	353	2.0
D25	143	229	4.7	138	757	4.5
D10	253	406	8.9	257	1260	7.6
YEARS						
YRSDAY	9	46	18	32	46	10
YRSLOW	—	45	17	31	45	—

Table 4.—Streamflow characteristics, in cubic feet per second, at selected stream-gaging stations (Continued)

Flow	Station name and site number					
	Assabet River at Maynard, Mass. (84)	Nashoba Brook near Acton, Mass. (89)	Hager Pond Outlet at Marlborough, Mass. (111)	Concord River below River Meadow Brook at Lowell, Mass. (121)	Merrimack River below Concord River at Lowell, Mass. (122)	East Meadow River near Haverhill, Mass. (186)
ANNUAL						
QA	195	20.6	—	619	7453	9.01
SDQA	42.2	7.86	—	188	1841	3.36
MONTHLY						
Q10	233	29.3	8.02	1257	12,730	3.88
	114	8.06	—	295	3779	1.87
	40.9	.63	3.21	38.3	1036	.75
SDQ10	74.5	9.11	—	289	2648	1.02
Q11	332	47.3	8.51	1866	17,690	20.2
	154	15.9	—	493	6022	8.62
	24.8	1.20	3.48	86.9	1843	1.33
SDQ11	109	13.6	—	375	3690	6.43
Q12	438	43.0	11.1	1503	18,880	24.1
	208	22.1	—	656	7125	11.2
	59.8	2.34	4.54	133	2127	1.36
SDQ12	128	15.1	—	366	3958	7.40
Q1	670	101	16.5	1996	18,530	17.1
	268	27.9	—	717	6806	8.39
	41.1	2.58	4.43	150	1621	1.55
SDQ1	193	27.4	—	415	3477	4.84
Q2	496	88.7	9.46	1856	18,400	24.0
	260	30.0	—	828	7186	10.9
	75.9	6.30	5.73	230	2105	3.47
SDQ2	122	20.7	—	414	3787	5.69
Q3	759	96.9	15.6	2236	45,780	34.9
	426	49.0	—	1262	12,770	21.2
	262	20.7	11.0	633	4132	9.78
SDQ3	150	19.2	—	360	6360	8.42

Table 4.—Streamflow characteristics, in cubic feet per second, at selected stream-gaging stations (Continued)

Flow	Station name and site number					
	Assabet River at Maynard, Mass. (84)	Nashoba Brook near Acton, Mass. (89)	Hager Pond Outlet at Marlborough, Mass. (111)	Concord River below River Meadow Brook at Lowell, Mass. (121)	Merrimack River below Concord River at Lowell, Mass. (122)	East Meadow River near Haverhill, Mass. (186)
MONTHLY (Continued)						
Q4	454	71.2	12.0	2303	35,020	41.8
	345	42.9	—	1248	19,300	21.4
	210	12.7	10.7	377	8795	6.48
SDQ4	87.3	16.2	—	478	6329	9.85
Q5	406	57.0	9.50	1599	24,770	21.9
	237	26.4	—	783	11,660	12.3
	134	8.59	7.55	283	4093	4.36
SDQ5	73.4	14.1	—	299	4566	6.24
Q6	375	40.0	6.20	1289	11,740	24.9
	124	12.6	—	450	5856	6.93
	49.5	2.96	4.39	116	1825	2.30
SDQ6	90.6	9.51	—	250	2838	6.29
Q7	209	16.4	4.44	1512	14,520	11.8
	81.1	5.49	—	258	3267	3.80
	26.0	.68	3.22	50.0	1161	.40
SDQ7	55.1	4.64	—	252	2159	3.86
Q8	117	10.6	7.38	1403	10,110	3.21
	58.6	3.23	—	224	2652	1.24
	26.9	.17	2.97	33.1	901	.24
SDQ8	29.7	2.88	—	259	1671	1.00
Q9	124	11.2	4.92	1694	19,650	5.30
	66.3	3.40	—	238	3032	1.67
	24.9	.27	2.65	25.4	895	.21
SDQ9	35.6	3.43	—	310	2935	1.62
LOW FLOW						
7Q2	20.1	.48	—	71.9	1335	.38
7Q10	15.1	.12	—	32.2	930	.11

Table 4.—Streamflow characteristics, in cubic feet per second, at selected stream-gaging stations (Continued)

Flow	Station name and site number					
	Assabet River at Maynard, Mass. (84)	Nashoba Brook near Acton, Mass. (89)	Hager Pond Outlet at Marlborough, Mass. (111)	Concord River below River Meadow Brook at Lowell, Mass. (121)	Merrimack River below Concord River at Lowell, Mass. (122)	East Meadow River near Haverhill, Mass. (186)
FLOW DURATION						
D99	17.8	0.18	2.6	33.0	520	0.16
D95	24.9	.54	2.8	61.9	1150	.38
D90	33.4	1.1	3.1	91.8	1590	.60
D75	57.1	3.5	4.3	186	2580	1.5
D70	69.5	4.6	4.6	225	2960	1.9
D50	140	11.4	6.5	460	4980	5.0
D25	271	28.7	9.4	894	9640	12.2
D10	428	53.9	13.4	1390	16,900	23.5
YEARS						
YEARSDAY	11	18	3	45	58	12
YEARSLOW	10	17	—	44	57	11

Table 5.—Summary of 7-day low-flow characteristics, drainage area, and period of record for low-flow partial-record stations and miscellaneous sites

Number in figures 2-5	Station number	Station name	Location	Period of record	Drainage area, in square miles	Estimated annual minimum 7-day mean low flow, in cubic feet per second, at indicated recurrence interval	
						2-year	10-year
			NASHUA RIVER BASIN				
1	01094340	Whitman River near Westminster, Mass.	State Route 2A	1974-75	21.6	—	--
2	01094342	Whitman River tributary near Westminster, Mass.	Depot Road	1971-73	—	—	—
3	01094350	Flag Brook near Westminster, Mass.	Cody Road	1971-73	1.20	0.5	0.3
4	01094355	Flag Brook near Fitchburg, Mass.	80 feet upstream from mouth	1973	12.5	—	—
5	01094370	Phillips Brook near Ashburnham, Mass.	Whitney Hill Road	1971	6.83	—	--
6	01094380	Phillips Brook near Westminster, Mass.	Potato Hill Road	1973	11.4	—	—
7	01094390	Phillips Brook near Fitchburg, Mass.	0.5 mile upstream from Westminster Hill Road	1971	14.8	—	—
8	01094395	Phillips Brook 800 feet above mouth, near Fitchburg, Mass.	800 feet upstream from mouth	1973	15.7	—	--
9	01094398	North Nashua River near Fitchburg, Mass.	Depot Street	1973	57.7	—	—
11	01094430	[1]Falulah Brook at Fitchburg, Mass.	Pearl Street	1972-74	12.0	.3	<.1
12	01094440	[1]Falulah Brook near Fitchburg, Mass.	0.25 miles upstream from mouth	1973	18.2	—	--
13	01094450	North Nashua River at North Leominster, Mass.	Hamilton Street	1973-74	—	—	--
14	01094460	Monoosnoc Brook at Leominster, Mass.	Whitney Street	1971-74	11.0	1.1	.4

Table 5.--Summary of 7-day low-flow characteristics, drainage area, and period of record for low-flow partial-record stations and miscellaneous sites (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Drainage area, in square miles	Estimated annual minimum 7-day mean low flow, in cubic feet per second, at indicated recurrence interval	
						2-year	10-year
		NASHUA RIVER BASIN (Continued)					
15	01094480	Fall Brook at Leominster, Mass.	Elm Hill Avenue	1971-74	5.84	2.4	1.2
16	01094490	Fall Brook at Route 117 near Leominster, Mass.	State Route 117	1973	5.95	—	—
18	01094550	Wekepeke Brook near Lancaster, Mass.	State Route 117	1971-73	11.6	3.4	1.5
20	01094720	North Nashua River at North Main Street near Lancaster, Mass.	North Main Street	1973-74	—	—	--
21	01094730	North Nashua River at Lancaster, Mass.	Main Street	1973	—	—	--
22	01094750	Waushacum Brook near Sterling, Mass.	300 feet downstream from Waushacum Pond outlet	1971-73	4.98	<.1	<.1
23	01094760	Waushacum Brook near West Boylston, Mass.	Prescott Street	1971-74	7.42	.2	<.1
25	01095050	Stillwater River at Moores Corners, near Sterling, Mass.	State Route 62	1971-74	26.9	1.9	.8
26	01095200	Houghton Brook near Oakdale, Mass.	State Highway 140	1965-66	.69	—	—
27	01095220	Stillwater River near Sterling, Mass.	Muddy Pond Road	1971-74	31.6	2.9	1.4
28	01095330	Quinapoxet River near Holden, Mass.	Mills Street	1971-73	21.7	.4	.2
29	01095360	Asnebumskit Brook at Jefferson, Mass.	State Route 122A	1971-73	10.6	.4	.2
30	01095370	Asnebumskit Brook near Holden, Mass.	Mills Street	1971-74	12.9	1.7	.8

Table 5.—Summary of 7-day low-flow characteristics, drainage area, and period of record for low-flow partial-record stations and miscellaneous sites (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Drainage area, in square miles	Estimated annual minimum 7-day mean low flow, in cubic feet per second, at indicated recurrence interval	
						2-year	10-year
		NASHUA RIVER BASIN (Continued)					
31	01095380	Trout Brook near Holden, Mass.	Manning Street	1971-73	6.79	0.2	<0.1
32	01095410	Malden Brook at Oakdale, Mass.	Thomas Street	1971-73	1.26	.5	.3
33	01095430	Gates Brook at West Boylston, Mass.	State Highway 140	1971-73	2.78	.5	.2
35	01095520	[2]Nashua River at South Lancaster, Mass.	Mill Street	1973-74	130	—	—
36	01095530	Nashua River at Bolton Road, at Clinton, Mass.	Bolton Road	1973	—	—	—
37	01095800	Easter Brook near North Leominster, Mass.	Lancaster Avenue	1965	.92	—	—
38	01095840	Catacoonamug Brook at Shirley, Mass.	Lancaster Street	1971-73	19.1	3.7	1.7
39	01095880	Nonacoicus Brook near Ayer, Mass.	200 feet upstream from mouth	1971-73	18.9	1.4	.3
40	01095910	Mulpus Brook near Lunenburg, Mass.	State Route 225	1971-73	10.4	.9	.4
41	01095915	Mulpus Brook near Shirley, Mass.	State Route 2A	1971-74	15.6	1.5	.5
42	01095920	Nashua River near Ayer, Mass.	State Route 2A	1973-74	—	—	--
43	01095930	[3]Willard Brook near West Townsend, Mass.	State Route 119	1971-73	12.3	1.1	.4
44	01095940	Locke Brook at West Townsend, Mass.	West Meadow Road	1971-73	4.26	.0	.0
45	01095950	Mason Brook near West Townsend, Mass.	2000 feet downstream from New Hampshire State line	1971-73	9.26	.1	<.1

Table 5.--Summary of 7-day low-flow characteristics, drainage area, and period of record for low-flow partial-record stations and miscellaneous sites (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Drainage area, in square miles	Estimated annual minimum 7-day mean low flow, in cubic feet per second, at indicated recurrence interval	
						2-year	10-year
			NASHUA RIVER BASIN (Continued)				
46	01095960	Walker Brook near West Townsend, Mass.	Turnpike Road	1971-73	5.82	0.1	<0.1
47	01095970	Pearl Hill Brook near West Townsend, Mass.	1800 feet downstream from Pearl Hill Brook Pond	1971-73	5.91	.8	.3
48	01095980	[3]Squannacook River at Townsend, Mass.	Elm Street	1971-74	51.1	7.2	3.0
50	01096040	Squannacook River below Kittredge Road, near Shirley, Mass.	800 feet downstream from Kittredge Road	1973	—	—	—
51	01096200	James Brook near Ayer, Mass.	State Route 111	1971-73	3.90	<.1	<.1
52	01096300	Robinson Brook near Pepperell, Mass.	Shirley Street	1971-73	3.07	.1	<.1
54	01096502	Nissitissit River near Hollis, N.H.	500 feet upstream from Pepperell Road	1971-73	47.7	3.1	1.0
55	01096503	Nissitissit River at Pepperell, Mass.	Canal Street	1971-73	59.6	4.7	1.3
56	01096504	Reedy Meadow Brook at East Pepperell, Mass.	Lowell Road	1971-73	1.92	.5	.3
57	01096505	Unkety Brook near Pepperell, Mass.	River Street	1971-74	6.85	1.1	.5
			SALMON BROOK BASIN				
58	01096512	Cow Pond Brook near Groton, Mass.	Wharf Road	1975-78	8.44	1.4	.6
59	01096515	Salmon Brook at Main St. at Dunstable, Mass.	Main Street	1975-78	18.2	5.3	2.8

Table 5.—Summary of 7-day low-flow characteristics, drainage area, and period of record for low-flow partial-record stations and miscellaneous sites (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Drainage area, in square miles	Estimated annual minimum 7-day mean low flow, in cubic feet per second, at indicated recurrence interval	
						2-year	10-year
			STONY BROOK BASIN				
60	01096540	Stony Brook near Westford, Mass.	Town Farm Road	1975-78	23.8	4.0	1.6
61	01096546	Stony Brook at Chelmsford, Mass.	Twiss Road	1975-78	43.6	7.2	3.0
			LOWER MERRIMACK RIVER BASIN				
64	01096595	Beaver Brook below State line near Dracut, Mass.	1000 feet south of Mass.-N.H. State line	1975, 1977-78	86.8	4.6	1.9
65	01096598	Beaver Brook at Lowell, Mass.	10 feet upstream from Martin Street	1974	—	—	—
			CONCORD RIVER BASIN				
66	01096600	Assabet River at Westborough, Mass.	Fisher Street	1962-66, 1975-78	7.10	—	—
67	01096610	Hop Brook near Northborough, Mass.	U.S. Route 20	1975-78	—	.2	<.1
68	01096640	Assabet River at Northborough, Mass.	Railroad line east of School Street	1975-78	—	—	—
69	01096650	Rawson Hill Brook near Shrewsbury, Mass.	Reservoir Road	1962-66	2.04	—	—
70	01096700	Howard Brook at Northborough, Mass.	15 feet upstream from Whitney Street	1962-65	2.69	—	—
71	01096705	Howard Brook at railroad at Northborough, Mass.	Upstream from railroad	1976-78	7.53	.4	.1
72	01096750	North Brook tributary at West Berlin, Mass.	State Route 62	1962-66	8.28	—	—
73	01096800	North Brook at Berlin, Mass.	Jones Road	1962-66, 1978-81	11.0	—	—
74	01096805	North Brook near Berlin, Mass.	Whitney Street	1975-78	15.5	1.0	.2

Table 5.--Summary of 7-day low-flow characteristics, drainage area, and period of record for low-flow partial-record stations and miscellaneous sites (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Drainage area, in square miles	Estimated annual minimum 7-day mean low flow, in cubic feet per second, at indicated recurrence interval	
						2-year	10-year
		CONCORD RIVER BASIN (Continued)					
75	01096850	Mill Brook near Hudson, Mass.	Mill Road	1962-66	4.44	—	--
76	01096855	Danforth Brook at Hudson, Mass.	Cox Street	1975-78	6.59	0.2	<0.1
77	01096870	Assabet River at Cox Street near Hudson, Mass.	Cox Street	1978	73.7	—	—
78	01096880	Fort Meadow Brook near Hudson, Mass.	Chestnut Street	1975-78	5.29	.8	.3
79	01096900	Great Brook at East Bolton, Mass.	East End Road	1962-66	—	—	—
82	01096930	Elizabeth Brook at Route 117 at Stow, Mass.	State Route 117	1977-78	—	—	—
83	01096935	Elizabeth Brook at Wheeler Street at Stow, Mass.	Wheeler Street	1975-76	—	—	—
85	01097050	Assabet River at Main Street near Concord, Mass.	Main Street	1969	—	—	—
86	01097100	Guggins Brook near West Acton, Mass.	Liberty Square Road	1962-66	1.77	—	—
87	01097200	Heath Hen Meadow Brook at Stow, Mass.	West Acton Road	1962-65	3.83	—	—
88	01097280	Fort Pond Brook at West Concord, Mass.	400 feet upstream from Nashoba Brook	1975-78	24.9	2.4	.8
89	01097300	[4]Nashoba Brook near Acton, Mass.	State Route 27	1962-63	12.8	—	—
90	01097370	Nashoba Brook at West Concord, Mass.	150 feet upstream from mouth	1975-78	21.7	1.6	.4
91	01097390	Assabet River at Route 2 near Concord, Mass.	State Route 2	1975, 1978	—	—	--

Table 5.—Summary of 7-day low-flow characteristics, drainage area, and period of record for low-flow partial-record stations and miscellaneous sites (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Drainage area, in square miles	Estimated annual minimum 7-day mean low flow, in cubic feet per second, at indicated recurrence interval	
						2-year	10-year
			CONCORD RIVER BASIN (Continued)				
92	01097400	Spencer Brook near Concord, Mass.	Spencer Brook Road	1962-65, 1978-81	—	—	—
93	01097410	Spencer Brook at Angiers Pond, near Concord, Mass.	Angiers Pond outlet	1975	—	—	—
94	01097450	Jackstraw Brook at Westborough, Mass.	Upton Road	1965	1.19	—	—
95	01097460	Sudbury River near Hopkinton, Mass.	Fruit Street	1975-78	19.2	2.9	1.1
96	01097480	Sudbury River at Ashland, Mass.	Fountain Street	1975-78	35.1	4.0	1.5
97	01098315	Beaverdam Brook near Natick, Mass.	Boden Lane	1975-78	6.47	1.2	.4
103	01098520	Cochituate Brook at Saxonville, Mass.	School Street	1944	—	—	—
105	01098700	Hayward Brook at Wayland, Mass.	U.S. Route 20	1965	2.31	—	—
106	01098704	Ward Brook near Marlborough, Mass.	Unnamed Road near Marlborough	1977	—	—	—
107	01098705	Sewage Brook near Marlborough, Mass.	U.S. Route 20	1977-79	—	—	—
108	01098706	Tanic Brook near Marlborough, Mass.	Unnamed Road near Marlborough	1977	—	—	—
109	01098707	Broad Brook near Marlborough, Mass.	0.4 mile west of Nixon Road	1977	—	—	—
110	01098708	Nixon Brook near Marlborough, Mass.	0.15 mile west of Nixon Road	1977	—	—	—
112	01098714	Parmenter Brook near Sudbury, Mass.	East side of Grist Mill	1977	—	—	—
113	01098718	Prides Crossing Brook near Sudbury, Mass.	U.S. Route 20	1977	—	—	—
114	01098722	Grist Brook near Sudbury, Mass.	U.S. Route 20	1977-79	—	—	—
115	01098725	Wayside Brook near Sudbury, Mass.	U.S. Route 20	1977-79	—	—	—

Table 5.—Summary of 7-day low-flow characteristics, drainage area, and period of record for low-flow partial-record stations and miscellaneous sites (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Drainage area, in square miles	Estimated annual minimum 7-day mean low flow, in cubic feet per second, at indicated recurrence interval	
						2-year	10-year
		CONCORD RIVER BASIN (Continued)					
116	01098728	Nobscot Brook near Sudbury, Mass.	U.S. Route 20	1977	—	—	—
117	01098733	Hop Brook near Marlborough, Mass.	French Road	1977-79	—	—	—
118	01098760	Hop Brook at Sudbury, Mass.	Peakham Road	1975-78	11.7	5.2	3.0
119	01098795	Wash Brook near Sudbury, Mass.	Landham Road	1975-78	21.4	6.8	3.2
120	01099400	River Meadow Brook at Lowell, Mass.	Plain Street	1975, 1978	25.7	3.1	1.2
		LOWER MERRIMACK RIVER BASIN					
123	01100050	Trout Brook near Dracut, Mass.	Wheeler Road	1974	.70	.0	.0
124	01100100	Richardson Brook near Lowell, Mass.	Methuen Street	1965, 1973-74	4.22	.0	.0
125	01100200	Trull Brook near Lowell, Mass.	River Road	1973-74	4.40	<.1	.0
126	01100300	Fish Brook near Andover, Mass.	River Road	1973-74	3.59	.0	.0
127	01100350	Bartlett Brook near Dracut, Mass.	Salem Road	1974	1.71	—	—
128	01100400	Bartlett Brook near Methuen, Mass.	Lowell Street	1973-74	6.83	.0	.0
129	01100561	Spicket River near Methuen, Mass.	Hampshire Road	1973-74	62.1	—	—
130	01100562	Harris Brook near Methuen, Mass.	Cross Street	1974	4.90	—	—
131	01100563	Spicket River at Methuen, Mass.	Dam at Methuen	1974-75	73.8	—	—
132	01100565	Spicket River at Lawrence, Mass.	General Street	1973-75	77.5	5.4	1.2

Table 5.—Summary of 7-day low-flow characteristics, drainage area, and period of record for low-flow partial-record stations and miscellaneous sites (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Drainage area, in square miles	Estimated annual minimum 7-day mean low flow, in cubic feet per second, at indicated recurrence interval	
						2-year	10-year
		SHAWSHEEN RIVER BASIN					
133	01100570	Shawsheen River near Bedford, Mass.	Summer Street	1973-75	6.55	1.5	0.6
134	01100571	Shawsheen River at Great Road at Bedford, Mass.	Great Road	1974	7.13	—	—
135	01100572	Elm Brook tributary near Concord, Mass.	Virginia Road	1974	—	—	—
136	01100574	Elm Brook at Bedford, Mass.	Great Road	1973-75	5.88	.6	.2
137	01100576	Shawsheen River at Bedford, Mass.	800 feet upstream from Page Road	1973	13.3	—	—
138	01100578	Shawsheen River at Page Road at Bedford, Mass.	Page Road	1973-74	13.7	—	—
139	01100580	[5]Spring Brook near Bedford, Mass.	200 feet upstream from mouth	1973-74	2.25	—	—
140	01100582	Shawsheen River at Route 62 near Bedford, Mass.	State Route 62	1973	—	—	—
141	01100590	[5]Vine Brook near Bedford, Mass.	State Route 62	1973-75	9.94	.4	<.1
142	01100592	Shawsheen River at Middlesex Turnpike, Bedford, Mass.	Middlesex Turnpike	1973-74	27.2	—	—
143	01100593	McKee Brook near Billerica, Mass.	Albion Road	1974	—	.0	.0
144	01100595	Shawsheen River at Boston Road near Billerica, Mass.	State Route 3A	1974	31.1	—	—
145	01100598	Shawsheen River near Billerica, Mass.	Town of Burlington Water Dept. Intake Structure	1974	35.4	—	—

Table 5.—Summary of 7-day low-flow characteristics, drainage area, and period of record for low-flow partial-record stations and miscellaneous sites (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Drainage area, in square miles	Estimated annual minimum 7-day mean low flow, in cubic feet per second, at indicated recurrence interval	
						2-year	10-year
		SHAWSHEEN RIVER BASIN (Continued)					
147	01100603	Content Brook near Billerica, Mass.	Whipple Road	1973-75	5.21	1.1	0.2
148	01100604	Shawsheen River tributary No. 4 near Tewksbury, Mass.	Brown Street	1974	.19	.0	.0
149	01100605	[5]Heath Brook near Tewksbury, Mass.	Shawsheen Street	1973-74	2.14	<.1	<.1
150	01100606	Shawsheen River at Main Street near Tewksbury, Mass.	Main Street	1974	45.8	—	—
151	01100607	Meadow Brook at Kendall Street near Tewksbury, Mass.	Kendall Street	1973-74	1.52	.0	.0
152	01100608	Meadow Brook near Tewksbury, Mass.	Pinnacle Street	1973-75	4.08	.1	<.1
153	01100609	[5]Strong Water Brook near Tewksbury, Mass.	Shawsheen Street	1973-75	9.27	.9	.2
154	01100610	Shawsheen River near Tewksbury, Mass.	Mill Street	1974	55.5	—	—
155	01100611	Shawsheen River tributary at South Street near Tewksbury, Mass.	South Street	1974	2.88	—	—
156	01100612	[5]Shawsheen River tributary near Tewksbury, Mass.	Old Railroad Grade	1973-74	3.03	—	—
157	01100613	Shawsheen River tributary No. 2 near Tewksbury, Mass.	Shawsheen Street	1973-74	.37	—	—
158	01100614	[5]Shawsheen River at Route 93 near Tewksbury, Mass.	U.S. Route 93	1974	60.7	—	—
159	01100615	Shawsheen River near Andover, Mass.	800 feet downstream from Andover Street	1974	—	—	—
160	01100616	Shawsheen River tributary No. 3 at Ballardvale, Mass.	Ballardvale Road	1973-74	—	—	—

Table 5.—Summary of 7-day low-flow characteristics, drainage area, and period of record for low-flow partial-record stations and miscellaneous sites (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Drainage area, in square miles	Estimated annual minimum 7-day mean low flow, in cubic feet per second, at indicated recurrence interval	
						2-year	10-year
		SHAWSHEEN RIVER BASIN (Continued)					
161	01100617	Shawsheen River tributary No. 5 near Andover, Mass.	Chester Street	1974	--	—	—
162	01100618	Shawsheen River tributary No. 6 near Andover, Mass.	Abbot Street	1974	—	—	—
163	01100619	Bakers Meadow Reservoir outlet at Andover, Mass.	Argilla Road	1973-74	0.80	<0.1	<0.1
164	01100620	[5]Shawsheen River at Andover, Mass.	Horn Road	1973-74	68.9	—	—
165	01100622	Shawsheen River tributary No.7 at Andover, Mass.	Red Spring Road	1974	—	—	—
166	01100623	Rogers Brook tributary at Andover, Mass.	Stevens Street	1974	—	—	—
167	01100624	Shawsheen River at Essex Street at Andover, Mass.	Essex Street	1974	70.6	—	—
168	01100626	Shawsheen River at Route 28 at Andover, Mass.	State Route 28	1974	71.0	—	—
169	01100628	Hussey Brook near Andover, Mass.	Chandler Road	1974	—	—	—
170	01100630	[5]Shawsheen River near North Andover, Mass.	100 feet north of Andover-Lawrence Town line	1973-74	75.3	—	—
171	01100631	Shawsheen River at Route 114 near Lawrence, Mass.	State Route 114	1974	—	—	—
172	01100633	Shawsheen River tributary No. 8 near North Andover, Mass.	Waverly Road	1974	—	—	—
173	01100635	[5]Shawsheen River at Lawrence, Mass.	Railroad bridge	1974-75	78.0	—	—

Table 5.--Summary of 7-day low-flow characteristics, drainage area, and period of record for low-flow partial-record stations and miscellaneous sites (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Drainage area, in square miles	Estimated annual minimum 7-day mean low flow, in cubic feet per second, at indicated recurrence interval	
						2-year	10-year
			LOWER MERRIMACK RIVER BASIN				
174	01100640	Bare Meadow Brook near Methuen, Mass.	50 feet upstream from unnamed tributary entering from the north, 450 feet downstream from Oak Street	1974	—	0.0	0.0
175	01100641	Bare Meadow Brook tributary near Methuen, Mass.	25 feet upstream from State Route 113	1974	1.04	<.1	.0
176	01100650	Hawkes Brook at North Street, near Methuen, Mass.	North Street	1974	1.40	.0	.0
177	01100655	Hawkes Brook near Methuen, Mass.	High tension wires 0.2 mile upstream from mouth	1974	4.35	.0	.0
178	01100660	Bare Meadow Brook at Brookdale Avenue, Methuen, Mass.	Brookdale Avenue	1973-75	7.68	.2	.0
179	01100665	West Meadow Brook near Haverhill, Mass.	Forest Street	1974	1.43	—	—
180	01100685	Fishin Brook near Haverhill, Mass.	Hilldale Avenue	1974	.96	—	—
181	01100686	Little River near Haverhill, Mass.	Rosemont Street	1974	22.8	.8	<.1
182	01100688	Snows Brook near Haverhill, Mass.	50 feet downstream from Greenleaf Avenue	1974	4.01	.2	<.1
183	01100690	Little River at Haverhill, Mass.	Winter Street Bridge	1974	—	—	--
184	01100691	Little River below Winter Street, Haverhill, Mass.	500 feet downstream from Winter Street	1974	—	—	--
185	01100695	Johnsons Pond tributary at Haverhill, Mass.	200 feet upstream from Center Street	1974	3.03	—	—

Table 5.—Summary of 7-day low-flow characteristics, drainage area, and period of record for low-flow partial-record stations and miscellaneous sites (Continued)

Number in figures 2-5	Station number	Station name	Location	Period of record	Drainage area, in square miles	Estimated annual minimum 7-day mean low flow, in cubic feet per second, at indicated recurrence interval	
						2-year	10-year
		LOWER MERRIMACK RIVER BASIN (Continued)					
186	01100700	[4]East Meadow River near Haverhill, Mass.	10 feet downstream from State Route 110	1979-81	5.47	0.38	0.11
188	01100800	Cobbler Brook near Merrimac, Mass.	Highland Street	1965, 1974	.75	.0	.0
189	01100802	Cobbler Brook at East Main Street, Merrimac, Mass.	25 feet upstream from East Main Street	1974	2.46	.0	.0
190	01100808	Sawmill Brook at West Newbury, Mass.	Most northerly culvert on Stewart Street	1974	.52	.0	.0
191	01100810	Indian River near West Newbury, Mass.	Main Street	1974	1.43	.0	.0
192	01100815	Upper Artichoke Reservoir tributary No. 2 near West Newbury, Mass.	Indian Hill Street	1974	.91	.0	.0
193	01100817	Upper Artichoke Reservoir tributary near West Newbury, Mass.	Garden Street	1974	1.40	.0	.0
194	01100840	Powwow River near Amesbury, Mass.	Newton Road	1974	—	—	—
195	01100845	Powwow River at Main Street at Amesbury, Mass.	400 feet upstream from mouth of Back River	1974	—	—	—
196	01100847	[5]Back River Amesbury, Mass.	Fern Avenue	1974-75	5.14	.2	<.1

[1]Includes 2.16 mi^2 above outlet of Fitchburg Reservoir.
[2]Includes 119 mi^2 above Wachusett Reservoir.
[3]Excludes 2.16 mi^2 above outlet of Fitchburg Reservoir.
[4]Recording gage see table 2.
[5]Low flow depleted by withdrawal of ground water for municipal supply.

SELECTED REFERENCES

Benson, M. A., 1962, Factors influencing the occurrence of floods in a humid region of diverse terrain: U.S. Geological Survey Water-Supply Paper 1580B, 64 p.

Brackley, R. A., and Hansen, B. P., 1977, Water resources of the Nashua and Souhegan River basins, Massachusetts: U.S. Geological Survey Hydrologic Investgations Atlas HA-276.

_____1982, Hydrology and water resources of tributary basins to the Merrimack River from Salmon Brook to the Concord River, Massachusetts: U.S. Geological Survey Open-File Report 82-441, 35 p.

Brackley, R. A., and Wandle, S. W., Jr., 1982, Drainage divides, Massachusetts—Nashua and Concord River basins: U.S. Geological Survey Open-File Report 82-924, 22 maps.

_____1983, Drainage divides, Massachusetts—Ipswich and lower Merrimack River basins and northeast coastal basins: U.S. Geological Survey Open-File Report 83-209, 28 maps.

Briggs, J. C., and Silvey, W. D., 1984, Source, movement, and effects of nitrogen and phosphorus in three ponds in the headwaters of Hop Brook, Marlborough, Massachusetts: U.S. Geological Survey Water-Resources Investigations Report 84-4017, 55 p.

Gay, F. B., and Delaney, D. F., 1980a, Hydrology and water resources of the Shawsheen River basin, Massachusetts: U.S. Geological Survey Hydrologic Investigations Atlas, HA-614.

_____1980b, Hydrology and water resources of the lower Merrimack River basin, Masachusetts, from Concord River, Lowell, to Plum Island, Newburyport: U.S. Geological Survey Hydrologic Investigations Atlas HA-616.

Halliwell, D. B., Kimball, W. A., Screpetis, A. J., 1982, Massachusetts stream classification program, part I, Inventory of rivers and streams: Massachusetts Department of Environmental Quality Engineering and Department of Fisheries, Wildlife, and Recreational Vehicles, 126 p., appendix consisting of 3 pages.

Higgins, G. R., 1967, Yield of streams in Massachusetts: Amherst, Massachusetts, University of Massachusetts, Water Resources Research Center Publication 5, 175 p.

Hutchison, N. E., compiler, 1975, WATSTORE—National water data storage and retrieval system of U.S. Geological Survey—User's guide: U.S. Geological Survey Open-File Report 75-426 (revised), 791 p.

Johnson, C. G., 1970, A proposed streamflow data program for central New England: U.S. Geological Survey open-file report, 38 p., 1 appendix consisting of 11 pages.

Johnson, C. G., and Tasker, G. D., 1974, Progress report on flood magnitude and frequency of Massachusetts streams: U.S. Geological Survey Open-File Report 74-131, 41 p.

Knox, C. E., and Nordenson, T. J., 1955, Average annual runoff and precipitation in the New England-New York area: U.S. Geological Survey Hydrologic Investigations Atlas HA-7, 6 p.

Knox, C. E., and Soule, R. M., 1949, Hydrology of Massachusetts, part 1, Summary of streamflow and precipitation records: U.S. Geological Survey Water-Supply Paper 1105, 240 p.

Krejmas, B. E., 1982, Drainage divides Massachusetts--Blackstone and Thames River basins: U.S. Geological Survey Open-File Report 82-631, 12 maps.

Langbein, W. B. and Iseri, K. T., 1960, General introduction and hydrologic definitions, in Manual of hydrology, part 1, General surface-water techniques: U.S. Geological Survey Water-Supply Paper 1541-A, p. 1-29.

Langbein, W. B., and others, 1947, Topographic characteristics of drainage basins: U.S. Geological Survey Water-Supply Paper 968-C, p. 125-157.

Lautzenheiser, R. E., 1969, Snowfall, snowfall frequencies, and snow cover data for New England: Environmental Sciences Services Administration Technical Memorandum EDSTM 12, 15 p.

Male, J. W., and Ogawa, H., 1982, Low flows of Massachusetts streams: Amherst, Massachusetts, University of Massachusetts, Water Resources Research Center Publication 125, 152 p.

Meeks, W. C., 1977, Daily values statistics (program A969), in Hutchison, N. E., compiler, 1975, WATSTORE--National water data storage and retrieval system of the U.S. Geological Survey user's guide: U.S. Geological Survey Open-File Report 75-426 (revised), chap. IV, section G.

Price, W. E., Jr., and Meeks, W., C., 1977, Daily values monthly and annual statistics (program W4422), in Hutchison, N. E., compiler, 1975, WATSTORE--National water data storage and retrieval system of the U.S. Geological Survey user's guide: U.S. Geological Survey Open-File Report 75-426 (revised), chap. IV, section F.

Riggs, H. C., 1971, Discussion of probability distribution of annual droughts by Eratakulan S. Joseph: American Society of Civil Engineers Proceedings, v. 97, no. IR3, p. 540-541.

_____1972, Low-flow investigations: U.S. Geological Survey Techniques of Water-Resources Investigations, book 4, chap. B1, 18 p.

Thomas, D. M., and Benson, M. A., 1970, Generalization of streamflow characteristics from drainage-basin characteristics: U.S. Geological Survey Water-Supply Paper 1975, 55 p.

U.S. Department of Agriculture, 1972, Soil Conservation Service National Engineering Handbook, section 4, Hydrology: U.S. Department of Agriculture, Soil Conservation Service.

U.S. Federal Inter-Agency River Basin Committee, Subcommittee on Hydrology, 1951, Inter-agency coordination of drainage area data, notes on hydrologic activities: Water Resources Council, Subcommittee on Hydrology Bulletin no. 4, 48 p.

U.S. Geological Survey, 1977, National handbook of recommended methods for water-data acquisition: U.S. Geological Survey, chap. 7, 38 p.

_____1980, Water resources data for Massachusetts and Rhode Island, water year 1979: U.S. Geological Survey Water-Data Report MA-RI-79-1, 349 p.

U.S. Weather Bureau, 1959a, Climates of the states, Massachusetts: U.S. Weather Bureau, Climatography of the United States, Paper No. 60-19, 20 p.

_____1959b, Rainfall intensity-frequency regime, northeastern United States: U.S. Weather Bureau Technical Paper no. 29, 35 p.

Wandle, S. W. Jr., 1982, Estimating peak discharges of small, rural streams in Massachusetts: U.S. Geological Survey Open-File Report 80-676, 33 p.

_____1983, Low-flow frequency and flow-duration analysis of natural-flow streams in Massachusetts: Boston Society of Civil Engineers Section, American Society of Civil Engineers Journal, v. 69, no. 1, p. 87-110.

_____1984a, Gazetteer of hydrologic characteristics of streams in Massachusetts—coastal river basins of the North Shore and Massachusetts Bay: U.S. Geological Survey Water-Resources Investigations Report 84-4281.

_____1984b, Gazetteer of hydrologic characteristics of streams in Massachusetts—Connecticut River basin: U.S. Geological Survey Water-Resources Investigations Report 84-4282.

_____1984c, Gazetteer of hydrologic characteristics of streams in Massachusetts—Hudson River basin: U.S. Geological Survey Water-Resources Investigations Report 83-4250.

Wandle, S. W., Jr., and Frimpter, M. H., 1982, Drainage divides, Massachusetts—Taunton River and southeast coastal basins: U.S. Geological Survey Open-File Report 82-870, 24 maps.

Wandle, S. W., Jr., and Keezer, G. R., 1984, Gazetteer of hydrologic characteristics of streams in Massachusetts—Taunton and Ten Mile River basins and coastal river basins of Mount Hope Bay, Narragansett Bay, and Rhode Island Sound: U.S. Geological Survey Water-Resources Investigations Report 84-4283.

Wandle, S. W., Jr., and LeBlanc, J. A., 1984, Gazetteer of hydrologic characteristics of streams in Massachusetts—Thames River basin: U.S. Geological Survey Water-Resources Investigations Report 84-4287.

Wandle, S. W., Jr., and Lippert, R. G., 1984, Gazetteer of hydrologic characteristics of streams in Massachusetts--Housatonic River basin: U.S. Geological Survey Water-Resources Investigations Report 84-4285.

Wandle, S. W., Jr., and Morgan, M. A., 1984, Gazetteer of hydrologic characteristics of streams in Massachusetts—coastal river basins of the South Shore and Buzzards Bay: U.S. Geological Survey Water-Resources Investigations Report 84-4288.

Wandle, S. W., Jr., and Phipps, A. F., 1984, Gazetteer of hydrologic characteristics of streams in Massachusetts—Blackstone River basin: U.S. Geological Survey Water-Resources Investigations Report 84-4286.